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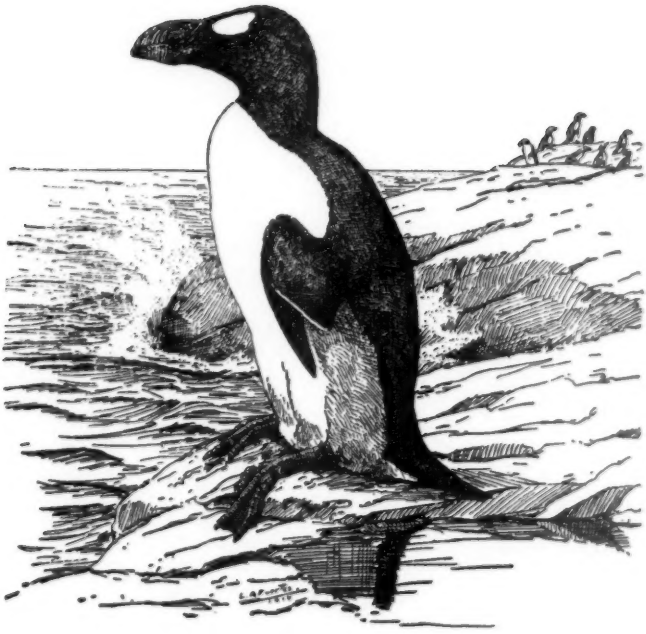

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LAND BIRDS OVER THE WESTERN NORTH ATLANTIC[1]

BY SUSAN IRVING SCHOLANDER

LAND birds are regularly reported migrating over such great stretches of water as the Gulf of Mexico, the Mediterranean, and the North Sea. The Golden Plover may cross a thousand miles and more of ocean without sight of land. The Greenland Wheatear travels from Arctic America to the European coast every year, and Snow Buntings are found not infrequently flying far out at sea. Particularly during the fall months, any ship in the North Atlantic, even hundreds of miles offshore, may be visited by land birds of many different species. Most of the published references to such encounters are scattered in short notes on single occurrences or lie buried among extensive data on sea birds. In a few cases they have been given special attention, however, as by Helms (1897), Trumbull (1904, 1905), Jesperson (1930), Nicholson and Nicholson (1931), and Allison, Barras-Smith, Darlington, and Romer (1951).

For a number of years a record of biological observations has been kept on expeditions in the North Atlantic from the Woods Hole Oceanographic Institution, and notes on the birds sighted at sea form the major part of this record. Dr. A. C. Redfield began the series of observations in 1933 and 1934, and used them to determine the distribution of petrels in the Gulf of Maine in relation to the abundance of plankton (1941). The observations which Dr. Redfield started were continued by Mr. Harold Backus and Mr. Dean F. Bumpus, with contributions by Mr. Alfred H. Woodcock and Mr. Frank J. Mather III. In 1951 Dr. Hilary Moore undertook an extensive analysis of the records, and from this data as well as his own presented a detailed picture of the seasonal distribution of oceanic birds in the North Atlantic, which has contributed greatly to knowledge of the migration patterns of petrels, shearwaters,

[1] Contribution Number 773 from the Woods Hole Oceanographic Institution.

phalaropes, and jaegers. The work of assembling the material on land birds observed during the Oceanographic expeditions has been undertaken at Dr. Redfield's suggestion, to see whether these occurrences at sea could be related to season, migratory routes, or weather conditions. In this analysis birds which habitually light on the water, such as ducks and geese, have not been included in the category of land birds.

Material.—The data were gathered during cruises in the years 1933 and 1934, 1936 through 1941, and 1949, most of them on the research vessel "Atlantis," with a few on the "Caryn." The area covered in this investigation extended from about 44° north latitude south through the West Indies, and from the coast of North America eastward to about 51° west longitude. The locations of all land birds recorded are given in figure 1, and all observations have been plotted on the maps in figures 2 and 3, according to month or season of the year.

Although every month is represented by notes from some section of this area, the extent of sea traversed and the number of observations made in each month vary considerably. Nevertheless for limited sections and periods, the data are sufficient to indicate prevailing seasonal conditions.

In plotting the data on the seasonal maps each time of entry in the biological notes was considered as one observation, regardless of whether land or sea birds or no birds at all were reported. In many cases one entry gives the total list of birds for one day. In other cases fairly regular watches were kept, and for one day there may be three or four entries made at different times. If only one entry was made per day the position of the point on the map is generally the ship's noon position; if there were several entries per day the positions may be somewhat closer to the actual location of observations.

Many of the birds seen were unidentifiable from the ship, but if they were clearly recognized as land birds they have been entered as such on the maps. Birds reported while the ship was in harbor or very close to shore have been omitted. A list of the species seen during these cruises, with their approximate distances from shore, is given in table 1, along with a number of records made by others in the same general area.

SEASONAL DISTRIBUTION

Winter, December–March (figure 2).—Through December and January practically no land birds were seen, and in February and

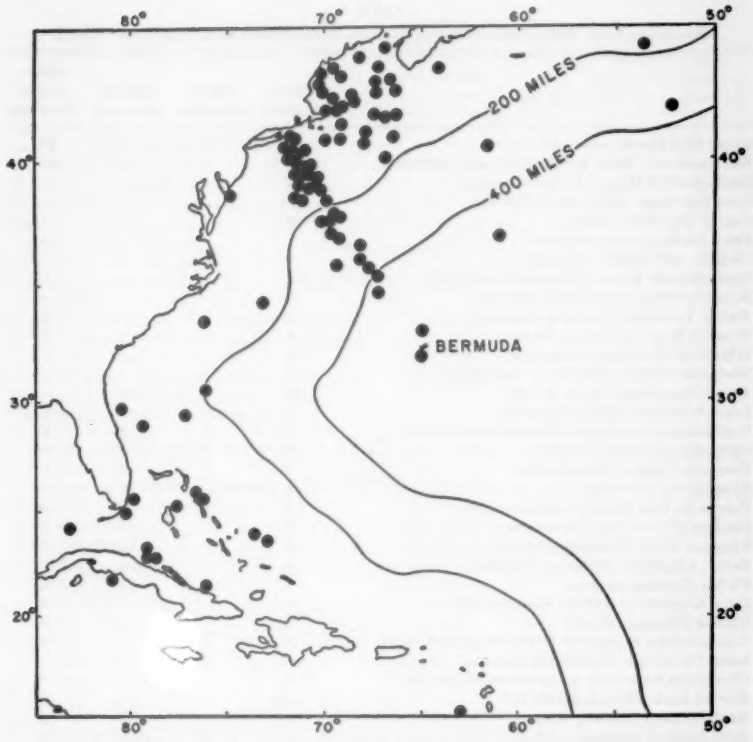

FIGURE 1. Positions of land birds seen from the Atlantis. Lines are drawn approximately 200 miles and 400 miles offshore; from these the distances from land were estimated for Table 1.

March there were only a few reported from southern waters. In fact, during this period entries in the notes frequently mention a complete absence of bird life of any kind for several days, even as long as a week at a time, in waters both to the north and south of Bermuda, to the east of the West Indies, and right among the West Indies themselves.

Spring Migration, April–May (figure 2).—Migratory activity during April and May is clearly reflected on the maps.

Off the coast of Florida and through the West Indies the movement appeared to be strongest around the middle of April, diminishing during the last week. Late in the month (April 27, 1952), however, at Bimini in the Bahamas, Mr. Marshall B. Bishop of the Lerner

TABLE 1

SPECIES OF LAND BIRDS OBSERVED AT SEA, WITH APPROXIMATE DISTANCES FROM SHORE.[1]

	Within 200 miles	*200 to 400 miles*	*Beyond 400 miles*	*Occurrence on Bermuda*[2]
Great Blue Heron (*Ardea herodias*)	5	8	1	F
Black-crowned Night Heron (*Nycticorax nycticorax*)	1	–	–	F
Sharp-shinned Hawk (*Accipiter striatus*)	5	–	–	A
Gray Sea Eagle (*Haliaeetus albicilla*)[3]	1	–	–	–
Osprey (*Pandion haliaëtus*)	6	–	–	A
Duck Hawk (*Falco peregrinus*)	1	–	–	A
Virginia Rail (*Rallus limicola*)	1	–	–	A
Semipalmated Plover (*Charadrius hiaticula*)[4]	2	–	–	F
Wilson's Plover (*Charadrius wilsonia*)	1	–	–	–
Ruddy Turnstone (*Arenaria interpres*)	2	–	–	F
Wilson's Snipe (*Capella gallinago*)	1	–	–	F
Whimbrel (*Numenius phaeopus*)[5]	1	–	–	–
Hudsonian Curlew (*Numenius hudsonicus*)	1	–	–	A
Baird's Sandpiper (*Erolia bairdii*)	sev.	–	–	–
Least Sandpiper (*Erolia minutilla*)	1	–	–	F
Semipalmated Sandpiper (*Ereunetes pusillus*)[6,7]	–	1	1	F
Sanderling (*Crocethia alba*)[4]	3	–	–	F
Domestic Pigeon (*Columba livia*)	–	2	1[9]	F
Barn Owl (*Tyto alba*)	1	–	–	A
Burrowing Owl (*Speotyto cunicularia*)[9]	1	–	–	–
Long-eared Owl (*Asio wilsonianus*)	1	–	–	F
Chimney Swift (*Chaetura pelagica*)	1	–	–	A
Belted Kingfisher (*Megaceryle alcyon*)	1	–	1	F
Flicker (*Colaptes auratus*)	4	–	1	A
Gray Kingbird (*Tyrannus dominicensis*)	2	–	–	A
Phoebe (*Sayornis phoebe*)	1	–	–	A
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	1	–	–	–
Least Flycatcher (*Empidonax minimus*)	–	1	–	–
Olive-sided Flycatcher (*Nuttallornis mesoleucus*)	1	–	–	A
Horned Lark (*Otocoris alpestris*)[10]	sev.	–	–	F
Bank Swallow (*Riparia riparia*)[8]	–	–	1	A
Barn Swallow (*Hirundo rustica*)	6	1[9]	sev.[7,8,11]	F
Red-breasted Nuthatch (*Sitta canadensis*)	5	–	–	A
Robin (*Turdus migratorius*)	2	–	1[9]	F
Golden-crowned Kinglet (*Regulus satrapa*)	1	–	–	A
Cedar Waxwing (*Bombycilla cedrorum*)	5	1	–	F
Starling (*Sturnus vulgaris*)	3	2	–	A
Black and White Warbler (*Mniotilta varia*)	1[12]	1	–	F
Nashville Warbler (*Vermivora ruficapilla*)[12]	–	–	1	A
Parula Warbler (*Parula americana*)	2	–	–	A
Yellow Warbler (*Dendroica petechia*)	2	–	–	A
Cape May Warbler (*Dendroica tigrina*)	1	–	–	A
Black-throated Blue Warbler (*Dendroica caerulescens*)	–	1	–	A
Myrtle Warbler (*Dendroica coronata*)[14]	sev.	–	–	F
Yellow-throated Warbler (*Dendroica dominica*)	1	–	–	–
Black-poll Warbler (*Dendroica striata*)	1	1	–	A
Pine Warbler (*Dendroica pinus*)	6	–	–	F
Prairie Warbler (*Dendroica discolor*)[14]	–	1	–	A
Palm Warbler (*Dendroica palmarum*)	5	–	–	F
Oven-bird (*Seiurus aurocapillus*)[13]	–	–	1	A
Water-thrush (*Seiurus noveboracensis*)[13]	1	–	–	F
Yellow-throat (*Geothlypis trichas*)	1	1[16]	–	F
Yellow-breasted Chat (*Icteria virens*)	–	1	1	–
Wilson's Warbler (*Wilsonia pusilla*)	1	–	–	–
American Redstart (*Setophaga ruticilla*)	4	–	1[13]	A
Meadowlark (*Sturnella magna*)	1	1	–	–

TABLE 1—*Continued*

	Within 200 miles	*200 to 400 miles*	*Beyond 400 miles*	*Occurrence on Bermuda*[2]
Red-wing (*Agelaius phoeniceus*)	2	–	–	–
Baltimore Oriole (*Icterus galbula*)	1	1[17]	–	F
Cowbird (*Molothrus ater*)	2	–	–	A
Dickcissel (*Spiza americana*)	1[4]	1	–	–
Purple Finch (*Carpodacus purpureus*)	1	–	–	–
Pine Siskin (*Spinus pinus*)[10]	sev.	–	–	A
Goldfinch (*Spinus tristis*)	1	–	–	A
Crossbill (*Loxia curvirostra*)[18]	–	1	–	F
Savannah Sparrow (*Passerculus sandwichensis*)	2[19]	4	2	A
Slate-colored Junco (*Junco hyemalis*)	3	1	–	A
White-crowned Sparrow (*Zonotrichia leucophrys*)	–	1	–	–
Golden-crowned Sparrow (*Zonotrichia coronata*)[20]	–	1	–	–
Fox Sparrow (*Passerella iliaca*)[19]	1	–	–	A
Swamp Sparrow (*Melospiza georgiana*)[12]	sev.	–	–	A
Song Sparrow (*Melospiza melodia*)	1	–	–	A
Snow Bunting (*Plectrophenax nivalis*)	1[21]	6	–	F

[1] Species listed according to The A.O.U. Check-List of North American Birds, Fourth Ed., 1931, and supplements.

[2] According to Bradlee, Mowbray, and Eaton, 1931. F = Frequent or regular; A = Accidental or rare.

[3] Crandall 1915.
[4] Rand 1929.
[5] Brewster 1909.
[6] Nicholson and Nicholson 1931.
[7] Murphy 1915.
[8] Jesperson 1930.
[9] Bent 1938.
[10] Helmuth 1920.
[11] Dahl 1892.
[12] Furlong 1933.
[13] Moore 1941.
[14] Bent 1953.
[15] Penard 1926.
[16] Robbins 1901.
[17] Butler 1926.
[18] Brown 1896.
[19] Trumbull 1905.
[20] Riney 1946.
[21] Smith 1901.

Marine Laboratory listed 21 species of migratory birds which arrived, both in flocks and singly, after a period of high winds. The birds stayed a few days and then disappeared. According to residents of Bimini this influx after storms is a regular occurrence at about the same time every year, and Wetmore (1927) also mentions observations of flocks of migratory birds in the Bahamas in April and early May. Our list in May of birds observed in the vicinity of the Bahamas and West Indies is considerably smaller than in April.

To the north there were no land birds in the Gulf of Maine after the first week of May.

Summer, June–July (figure 2).—One Barn Swallow (*Hirundo rustica*) on June 1 constitutes the only land bird record, and it might perhaps better be added to the spring observations. The ocean in midsummer appears to be as barren of land birds as in midwinter. Nicholson and Nicholson (1931) and Allison, Barras-Smith, Darlington, and Romer (1951) have also reported that July was a poor month for non-oceanic birds at sea.

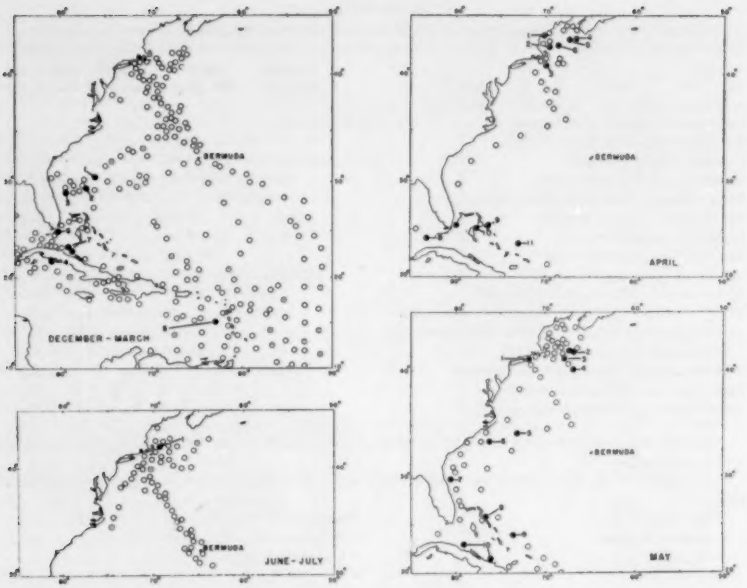

FIGURE 2. Observations during the winter, spring and summer. Dark circles indicate the positions of land birds; open circles show observations where no land birds were seen. Each circle usually represents from 1 to 3 observations, or as many as 10 in congested areas. The total number of observations, as well as the number of different years in which they were taken, is given below for each month. The land birds are listed under numbers corresponding to those on the map. An asterisk indicates that the bird landed on board or was caught.

December, 24 observations, between Cape Cod and Bermuda only, three years.

January, 179 observations, five years. 1. Domestic Pigeons.*

February, 132 observations, six years. 2. Wilson's Snipe ("lost"). 3. Landbird. 4. Yellow Warbler.* 5. Swallow.

March, 145 observations, six years. 6. Virginia Rail*; nuthatch. 7. Gray Kingbirds.* There were also, in March, 14 observations in the Gulf of Mexico not shown on the map. Five herons were recorded.

April, 140 observations, five years. 1. Landbirds. 2. Song Sparrow.* 3. Barn Swallow.* 4. Flicker; Palm Warbler. 5. Hawk; landbird. 6. Sharp-shinned Hawk. 7. Yellow-bellied Flycatcher*; Palm Warbler; Sharp-shinned Hawk*; Red-breasted Nuthatch*; landbirds. 8. Hawks; landbirds. 9. Pine Warbler. 10. Redstarts; Kingfisher; Palm Warbler; Cape May Warbler; finches; warbler. 11. Warbler. There were also 8 observations in the Gulf of Mexico in April, with 2 herons and 2 flocks of unidentified birds reported, all on southerly winds.

May, 132 observations, seven years. 1. Turnstones*; Red-wing; nuthatch; warbler; landbirds; all on one day after a storm in the vicinity of New York the day before. 2. Red-wing; Barn Swallow.* 3. Pine Warbler. 4. Barn Swallows. 5.

Fall Migration, August–November (figure 3).—In the last week of August the picture is different, and the first two weeks of September reflect a high point of activity in the Gulf of Maine. In October particularly, the presence of land birds is striking, especially if we make the reasonable assumption that the records obtained between Cape Cod and Bermuda constitute a representative cross section of large parts of the ocean. In November, land birds were reported during the first three weeks and not thereafter.

According to this reflection at sea of the migratory periods of land birds, the movement is under way in the spring from early April to early May. The much more striking southward movement is already well discernible in the last week of August, it increases markedly in early September, and may continue at this rate through October. In November the drop in numbers is pronounced, and the season is evidently over in this area by the end of November.

Warblers make up a considerable number of the birds reported from southern waters in the spring, and hawks were present there in the middle of April, with two records in April in the Gulf of Maine at a slightly later date. Five of the records in April and May were Barn Swallows, mainly from the waters off Cape Cod, or a little to the south. Swallows were seen again in August, but no later. The Cedar Waxwings (*Bombycilla cedrorum*), hawks, Red-breasted Nuthatches (*Sitta canadensis*), and Flickers (*Colaptes auratus*) seem to travel in August and September, and September is the only month in which sandpipers are mentioned. Warblers and flycatchers were also evident throughout September and October, and ducks (not recorded on the maps) were increasing in October, even considerably offshore. Starlings (*Sturnus vulgaris*), sparrows, Juncos (*Junco hyemalis*), Snow Buntings (*Plectrophenax nivalis*), and Great Blue Herons (*Ardea herodias*) are most conspicuous in October and November.

Weather conditions associated with the occurrence of land birds at sea.—In many cases, weather data were set down in the Atlantis records at the same time as the birds' appearance, and this information could be easily checked and supplemented by the ship's log. In table 2 the observation area has been divided into four regions from north to south, and the numbers of land birds are given for each region under the wind direction with which they were associated.

If the land birds seen at sea have been blown from their normal

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Barn Swallow. 6. Chimney Swift. 7. Landbird. 8. Redstarts. 9. Black-poll Warbler; hawk. 10. Parula Warblers.

June, 142 observations, five years. 1. Barn Swallow.

July, 70 observations, five years.

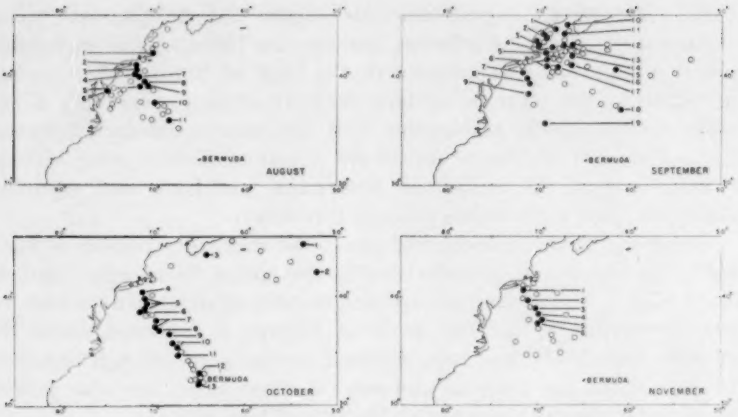

FIGURE 3. Observations during the fall.

August, 135 observations, six years. 1. Landbird. 2. Pine Warbler.* 3. Cedar Waxwing; landbirds. 4. Black-crowned Night Heron*; swallows. 5. Olive-sided Flycatcher*; landbirds. 6. Ospreys. 7. Warbler. 8. Landbird. 9. Cedar Waxwings.* 10. Swallow. 11. Cedar Waxwing.*

September, 120 observations, six years. 1. Least Sandpiper*; Cedar Waxwing*; Palm Warbler.* 2. Sandpipers; Long-eared Owl*; landbird. 3. Hudsonian Curlew; Yellow Warbler*; sandpipers; landbird. 4. Wilson's Warbler.* 5. Sandpipers. 6. Flycatcher; landbirds. 7. Red-breasted Nuthatch*; Flickers*; Ospreys; landbirds. 8. Cedar Waxwing*; Baird's Sandpipers, in a flock, one caught in the rigging; sandpipers. 9. Goldfinch; Pine Warbler*; Phoebe.* 10. Sharp-shinned Hawk. 11. Hawk. 12. Red-breasted Nuthatch. 13. Yellow-throat.* 14. Red-breasted Nuthatch; Palm Warbler*; landbirds. 15. Yellow-breasted Chat. 16. Baltimore Oriole. 17. Red-breasted Nuthatch. 18. Flicker.* 10. Least Flycatcher.*

October, 137 observations, five years. 1. Pine Warbler. 2. Snow Buntings.* 3. Duck Hawk; Flicker; landbirds. 4. Landbirds. 5. Cowbirds; Robin; Starlings; Golden-crowned Kinglet*; Yellow-throated Warbler*; warblers*; landbirds; a storm at sea may have accounted for the occurrence of 10 of these birds. 6. Wilson's Plover.* 7. Landbirds. 8. Great Blue Herons; Meadowlark; Starling; landbirds. 9. Landbird. 10. Starling; Black-poll Warbler*; White-crowned Sparrow*; Dickcissel*; Black and White Warbler*; Black-throated Blue Warbler*; Savannah Sparrows*; Slate-colored Junco*; flycatchers; Great Blue Herons; landbird. 11. Kingfisher; landbird. 12. Yellow-breasted Chat*; Savannah Sparrows. 13. Great Blue Heron.

November, 42 observations, three years. 1. Pine Warbler. 2. Slate-colored Juncos; landbird. 3. Purple Finch*; Meadowlark; Great Blue Heron; landbirds; all seen on one day after a storm recorded at Nantucket the day before. 4. Barn Owl; Robin; Great Blue Herons; landbirds; all these came on one day with wind NW 6. 5. Snow Buntings. 6. Great Blue Heron; landbird.

course, one would expect to find them associated chiefly with winds blowing offshore. This was generally true for the land birds seen from the Atlantis. It was also true that these winds were generally the prevailing winds of the region where the birds were seen, which may cloud the issue somewhat. In the three northern sections listed on table 2, the prevailing winds are the Westerlies, with a northeast component in the fall. In general the nearest land would lie to the west or north. Most of the land birds came on winds from these directions.

TABLE 2

NUMBER OF BIRDS IN RELATION TO DIRECTION OF WIND AT TIME OF BIRDS' APPEARANCE.

	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
1. *Latitudes from southern Nova Scotia to southern Cape Cod*									
Spring (Apr. and May)	1	1	1	1	4	2	0	0	0
Fall (Aug. thru Oct.)	4	8	9+	11+	1	0	0	2	0
Total (Jan. and Mar. thru Oct.)	5	9	15+	12+	5	3	0	2	0
2. *Latitudes from southern Cape Cod to Bermuda*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Spring (Apr. and May)	0	2	0	9+	0	0	0	1	0
Fall (Aug. thru Nov.)	4	9	10	48+	17	37+	5	1	5+
Total (Jan. thru Dec.)	4	11	10	57+	17	37+	5	2	5+
3. *Latitudes from Bermuda to West Indies*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Total (Jan. thru June, Oct. and Dec.)	0	7	0	1	0	0	0	3	1
4. *Latitudes from West Indies to coast of South America*									
	Calm	*SW*	*W*	*NW*	*N*	*NE*	*E*	*SE*	*S*
Total (Jan. thru May)	1	0	0	1	0	7	19+	5+	0

Among the West Indies in the spring, the Northeast Trades are the prevailing winds, and it will be seen that in the southernmost section on table 2, all the land birds but one appeared on easterly winds. Since land occurred in almost every direction, its position in relation to the wind could not be considered.

A check of coastal weather conditions in the Daily Weather Maps for the two northern sections in table 2 indicated that offshore winds generally prevailed for the areas and times in which land birds were seen at sea. At least 140 out of about 195 birds during the spring and fall came in periods of offshore winds.

If it is assumed that the land birds observed from the Atlantis came almost directly from the nearest shore, the journey over the sea for most of them would have been well within 200 miles (table 1). This is a minimum estimation, and moreover it may not apply at all to the situation in the fall between Cape Cod and Bermuda, where almost as many birds were accompanied by winds from the north or northeast as by the west or northwest winds from the nearest

land. If these birds actually came from land to the northeast, they might have been traveling for 400 miles or more, although in table 1 they might still appear in the category of 200 miles from shore. In the month of October only 26 birds appeared to be from the nearest land, whereas 34 apparently came from farther eastward. Of the latter group an unusually large proportion, 15, landed on the ship. In summary, it can be said that out of the total number of birds, some 240, reported from the Atlantis, about 128 were definitely associated with winds directly from the nearest land, and about 54 came in the fall when winds were blowing which might have carried them a considerably greater distance from the north or east.

When the wind was directly from the east, however, it is clear from table 2 that land birds were very rarely seen at sea north of the West Indies, and a number of the days and periods of easterly winds during the winter, even among the West Indies, were marked by a complete absence of both land and sea birds. Out of a total of 36 such days, which occurred in stretches of from two days to over a week, 25 had easterly winds.

Bad weather and the force of the wind, as well as its direction, might be expected to have some effect on the numbers of land birds over the sea, but in the Atlantis records this was not generally striking. Throughout the year most of the birds were recorded on days of fair weather in all areas, and the winds with which they came were in the majority of cases light to gentle, ranging between 1 and 3 on the Beaufort scale, or approximately 2 to 13 miles an hour. Between Cape Cod and Bermuda during the fall months, however, where birds were most frequently seen at some distance from shore, there seems to be some correlation between numbers and the force of the wind (table 3A); and in the month of October, it appears that the presence of a fair proportion of the birds could be attributed to ocean gales or storms in the vicinity (table 3B). This result is hardly surprising in a month which reflects not only the increasing storminess of the season but the height of the migration period as well. That the storms encountered in November were so few in table 3B is undoubtedly due to the comparatively small number of observations taken during the month. Except in the month of October there seems to be no marked relation between storms and numbers of land birds at sea. Out of the whole period only three of the many days which could be called outstanding for land bird occurrences (with more than five birds reported) could possibly be associated with storms either on land or sea. (These days are noted under the maps for May, October, and November, figures 2 and 3.) Williams

(1950) stated that night migration along the Gulf of Mexico ceased when strong winds were blowing, and Allison, Barras-Smith, Darlington, and Romer (1951) reported that a gale in September produced a marked cessation in the movements of birds at sea. In general birds must be able to cope with stormy weather, or avoid it; the fate of those that fail, on the other hand, is nowhere more evident than over the sea.

TABLE 3

A. NUMBER OF BIRDS IN RELATION TO THE FORCE OF THE WIND (BEAUFORT SCALE) BETWEEN CAPE COD AND BERMUDA DURING THE FALL.

Force	*Calm-1*	*2–3*	*4–5*	*6–7*
September	7	10+	5	1
October	3	23+	44+	1
November	2	6	10	7+

B. NUMBER OF BIRDS IN RELATION TO STORMS AT SEA OR ALONG COAST DURING SPRING AND FALL.[1]

Month	*Number of years*	*Total number of birds observed*	*Number of storms in vicinity of observation area*	*Number of birds observed in storm vicinity*
April	3	27+	7	1
May	3	13+	5	6+
August	4	18+	3	6
September	4	39+	8	3
October	5	79+	8	30
November	2	13+	3	3

[1] Storm data from Monthly Weather Review, 1933–1940.

Discussion.—The seasonal pattern of land birds over the North Atlantic is similar to that of the oceanic birds described by Moore (1951), allowing for differences in numbers and range. Periods of greatest activity and in many cases areas of concentration correspond rather closely. There are however at least two outstanding differences. For the oceanic birds, the migratory movement in the spring seems to be generally just as pronounced as in the fall. This is not true of the land birds. In addition it is evident in the numbers and behavior of the birds which Moore discussed that they are following a definite course over the sea. In the case of the land birds reported from the Atlantis there is nothing to suggest that they are flying over a normal route. The majority of records are of individual birds, seldom more than two of a kind during a month. There are only one or two references, in the fall, to migrating flocks. A comparatively large number of the birds landed on the ship, or were caught, and many of the smaller birds, particularly warblers, were either found dead or died shortly after landing, which would point to a rather common state of exhaustion, and probable disorientation.

In the case of Snow Buntings, occurrences over the Atlantic may be more than accidental, however. Three in October constitute the most easterly of the Atlantis land bird records, and they have been found by many others at much greater distances from shore. Helms (1897) mentions them with the Wheatears as the only birds seen regularly in the North Atlantic. A Snow Bunting banded in New York was recaptured a few months later in a flock west of Iceland (Cooke 1945), and Allison, Barras-Smith, Darlington, and Romer (1951) recorded 20 in September at a weather ship station west of the British Isles.

Swallows also appear rather often in lists of land birds at sea. Our records were not very far offshore, but Dahl (1892) and Murphy (1915) reported a number of Barn Swallows east of Bermuda, which were assumed to be on migration to South America. Murphy's record was made 360 miles from land, and Jesperson (1930) found them as much as 600 miles off shore. Both Snow Buntings and Barn Swallows are frequent visitors on Bermuda.

In view of the number of land birds southeast of Cape Cod in the fall, it was of interest to see how many of the species recorded there are known also from Bermuda (table 1), which lies near the eastern limit of most of the Atlantis observations, some 600 miles from the North American coast. According to the checklist of Bradlee, Mowbray, and Eaton (1931) 11 species of land birds are resident in Bermuda, four species are given as present during the winter, and 84 species appear fairly frequently or regularly during the migration seasons. By far the greatest number (138) are only occasional or accidental visitors. These include most (25) of the species seen in the region from the Atlantis. Of the four species recognized as winter residents on Bermuda, the Great Blue Heron, the Belted Kingfisher (*Megaceryle alcyon*), and the Black and White Warbler (*Mniotilta varia*) were seen from the Atlantis, as well as 13 of the species described as not uncommon in Bermuda in the fall. Only the Great Blue Herons and possibly the sandpipers appeared in any numbers which might suggest a regular migratory route. Several of the species seen at sea, in view of their location on the Atlantis maps, could well be expected in Bermuda, although they do not appear on the checklist of 1931. In comparison with the total list of species from Bermuda, the Atlantis list is meager. For a bird traveling over the ocean the chance of making a landfall on an island group some 200 square miles in area is considerably greater than the possibility of finding a ship at sea, and the list of Bermuda species is a compilation of the observations of nearly 100 years.

In October, fall migration in Bermuda is at its height; the spring migration is less noticeable, and the number of birds there is lowest in June and July (Bradlee, Mowbray, and Eaton 1931). The same general pattern appears also in the Atlantis records. There are many references to the effect of storms on the migratory bird population of Bermuda, and the presence of most of the species recorded on the island has been attributed to unfavorable winds which blow the birds off their regular courses (Reid 1884, Bradlee, Mowbray, and Eaton 1931). On Bermuda, as on the Atlantis, the appearance of land birds would seem to depend largely on wind conditions along the American coast.

There are many conflicting reports as to whether migratory flight is associated with certain wind directions, or proceeds regardless. These are mainly based on local observations of the arrival of migrant birds. In the two northern sections included on table 2, no clear seasonal difference in wind directions can be seen which might be associated with a seasonal difference in migration direction, but these birds at sea cannot be taken as representing the normal pattern. If a broader point of view is taken of the course of migration in relation to the pattern of prevailing winds, it appears that correlations may exist, as has been suggested by McMillan (1940), Landsberg (1948), and Lowery (1951). An easterly wind is a determining factor in the appearance of southbound migrants in the British Isles (Williamson 1952), and Bradlee, Mowbray, and Eaton (1931) found that the prevailing winds, from the south and southwest, were related to the preponderance of southern North American species among the "accidentals" on Bermuda.

All but 15 of the 248 land birds reported from the Atlantis came while the prevailing winds were blowing in the region where they were seen. In the spring the prevailing westerly or northerly winds along the Atlantic coast would be of little help to a northbound migrant, and the comparative scarcity of records at sea in the spring may indicate that at this season the main stream of migration does not pass along the coast, but farther inland. In the fall however, the prevailing north or west winds along the coast would correspond somewhat better to the direction of migration, and the numbers of land birds over the sea seem to indicate that the coastal route is much more popular at this season than it is in the spring. It is also evident that, although a fall migrant might derive some advantage from tail winds which would help it eastward to the coast and southward, it would have to pay the price of running special risks, such as overshooting the land in darkness, or blowing out to sea with the

strong winds characteristic of the season. Whether or not the prevailing wind may be a factor in determining the course of migration along the coast in the fall, the vulnerability of such a route at that season is clearly illustrated in the Atlantis records of land birds at sea.

Summary.—A record of the birds observed in the western North Atlantic was kept for eight years by members of expeditions from the Woods Hole Oceanographic Institution. The data on land birds have been assembled from these notes and entered on a series of seasonal maps. Fifty-four species of land birds were identified from the ship. Most of them were within 200 miles from shore, but some were more than 400 miles from the nearest land. Only during the migration seasons were land birds found on the sea in any numbers, some in the spring and many more in the fall. Their appearance could generally be associated with winds blowing from the direction of land, and since a relatively large number lighted on the ship, exhausted, there seems to be little doubt that these birds at sea were blown off course and victims of the same conditions which determine the long list of "accidentals" on Bermuda. In the fall their numbers seemed also to have some correlation with the force of the wind, as well as with storms in October. From a comparison of spring and fall records it seems that the main course of migration may pass farther inland in the spring and nearer to the coast in the fall, where it would be particularly vulnerable to the stress of weather conditions.

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REMARKS ON THE ORIGINAL SOURCES OF DISPLAYS

BY M. MOYNIHAN

THERE have been many attempts, within the last few years, to trace the evolution of individual behavior patterns and groups of patterns. This is particularly true of the "ritualized" activities or "displays"; i.e. those peculiarly standardized and often exaggerated performances, including all vocalizations and many movements and postures, which have become specialized and modified as social signals or releasers. Comparative studies of such performances have yielded results of interest to both ethologists and systematists; and the stage has now been reached when it is possible to begin to generalize these results, to draw some tentative conclusions about the sources from which some of the displays have been derived.

Tinbergen has already discussed these sources in an earlier review, (1952), and some problematic aspects of their evolution have been also noted elsewhere, (e.g. in Bastock, Morris, and Moynihan, 1953); but the whole subject might, perhaps, be usefully reviewed and reassessed once again, as briefly as possible, in the critical light of some more recent information and conjecture.

The origin of vocalizations remains obscure (although the suggestions of Spurway and Haldane, 1953, are very interesting in this connection); but a good deal is now known about the nature of the elements that have been most frequently incorporated into ritualized movements and postures.

The commonest of these elements are "autochthonous" intention or low-intensity behavior patterns.

An "autochthonous" activity is one that is caused by its usual drive (see Kortlandt, 1940). Thus, for instance, an attack movement is said to be autochthonous when it is produced by attack motivation. The terms "motivation" and "drive" are used interchangeably here; as short-hand for "the complex of internal and external states and stimuli (usually or normally) leading to a given behaviour." This usage follows Thorpe, 1951, in a somewhat altered form.

Many displays seem to have been derived from autochthonous intention movements alone. The "Agressive Upright" threat display of many gulls is a good example of this type (see Moynihan, 1955). It is motivated by attack and escape drives; and it includes indications of advance and pecking (attack intention movements) plus indications of retreat or avoidance (escape intention movements), combined in a particularly standardized arrangement. Further examples, in other species, are described in detail by Tinbergen (1952).

Other displays have been derived from autochthonous movements of higher intensity. The "Swoop" and "Soar" displays of the Black-headed Gull, for instance, include attack and escape elements of much greater vigor and elaboration (Moynihan, 1955).

The most interesting displays, however, are those that would appear to have been derived, in part at least, from an "extraneous" or superficially "irrelevant" source, i.e. from the so-called "displacement activities" and some other behavior patterns that are sometimes confused with displacement.

The generally accepted definition of a displacement activity, as ethologists use the term, is "an activity belonging to the executive motor patterns of an instinct other than the instinct(s) activated" (Tinbergen, 1952). Such a reaction is supposed to occur, in most cases, when an instinct or drive is thwarted, when it is prevented from finding its usual expression. The "energy" of the blocked motivation is then supposed to "spark-over" somewhere in the central nervous system, in a peculiar and as yet unexplained fashion, to find an alternative outlet in the performance of some apparently irrelevant act (see Bastock *et al.*, 1953). These apparently irrelevant acts, being caused by some drive other than their usual or normal one, are called "allochthonous."

The most plausible examples of displacement or displacement-like reactions, in this sense, are provided by certain "nervous" movements in man. It is well known that human beings may show unexpected "out of context" activities (e.g. yawning, scratching, playing with keys or other objects, etc.), under various conditions of stress and conflict.

It is also probable that similar reactions do sometimes occur in other animals. Thus, for instance, a male Three-spined Stickleback will show "fanning" (usually a parental activity) when its sex drive is thwarted during "courtship" (Tinbergen and van Iersel, 1947), and a Black-headed Gull will show preening and/or nest-building when its brooding drive is thwarted during the incubation period (Moynihan, 1953).

Many apparently irrelevant or "extraneous" movements of birds, therefore, have been interpreted as displacement activities of this sort. Such interpretations, however, are often obviously unwarranted. There is every reason to believe, in fact, that the great majority of the so-called "displacement activities" reported in the ornithological and ethological literature can be adequately explained without assuming the existence of any exceptional "spark-overs" in internal motivation. (It is true that any change in behavior of

any sort, "normal" as well as "abnormal," may involve some type of internal switch; but this is usually much slighter, and/or less transitory, than the "spark-over" posited to explain most of the presumed displacements.) Of the many apparently irrelevant acts cited by Tinbergen (1952), for instance, it is probable that no more than a third, at best, are really displacement activities in the conventional ethological sense.

A few examples, from his list, should make this clear.

Many of the cited activities seem to be purely autochthonous, direct and usual reactions to internal and external stimuli, with only the most superficial and misleading appearance of unexpectedness or irrelevance. Thus, for instance, the "courtship" behavior of caged Willow Warblers, "when showing the inhibited migratory movements called 'migratory restlessness'," can hardly be a typical displacement. These birds must almost certainly possess some activated "courtship" motivation. Similarly, the "song" of Skylarks after escaping from a Duck Hawk or Hobby is most unlikely to be allochthonous. The "songs" of many birds are hostile (i.e. produced by attack and escape motivation), and this situation is certainly one in which autochthonous hostility might even be expected as a general rule.

Other activities have been misinterpreted because of their peculiar orientation. These are the "redirection activities."

Redirection movements, like displacement, seem to occur when an instinct or drive is thwarted, and their physical form may be very similar to that of some displacement reactions; but the two types of activity are quite fundamentally and definitely different in nature, i.e. in internal causation.

Redirection movements can be defined as autochthonous activities of a drive directed toward an object or animal other than the one releasing and usually directing them (although the releasing object or animal remains available, or partly available, as a potential goal at the time) (see Bastock *et al.*, 1953). An example is provided by the behavior of a Prairie Falcon (cited by Bent, 1938), when disturbed at the nest by a human intruder. Both the attack and escape drives of this falcon were immediately activated; but they were largely incompatible, and the escape drive was strong enough to prevent the bird from venting its attack drive upon the real offending object, the actual disturber. The falcon then found an outlet for its thwarted attack motivation by pouncing upon some other birds, a Barn Owl and a Raven, which happened to pass by at a convenient moment. This sort of "unprovoked" attack upon an inoffensive scapegoat is the commonest type of redirection.

It is also the type of redirection that has been most frequently confused with displacement.

Thus, to give some more examples from Tinbergen's list, the pecking at the ground by many passerines during fights, and other hostile encounters, is probably redirected attack pecking rather than displacement feeding.

More complex are such performances as "grass-pulling" in Herring Gulls. When two of these birds become engaged in a territorial boundary dispute, one or both may begin to peck and pull, violently, at the nearby vegetation. Tinbergen notes that the violence of this performance is probably an expression of redirected aggressiveness, but he also believes that the activity includes an additional nest-building component (which must be displacement in these non-nesting circumstances). He bases this belief upon the fact that vegetation is used as nest-material, and, more important, that the vegetation pulled up by "grass-pulling" is usually thrown away with a sideways jerk of the head, a sideways movement also shown during the construction of an actual nest. This evidence of displacement is not, however, completely convincing. There is no obvious reason why redirected aggressiveness should not be vented upon vegetation as well as any other object; and the distinctive sideways jerking might be nothing more than an immediate and simple reaction to the presence of some non-edible material in the bill. In other words, there are no real indications that any internal motivation has "sparked-over" in the course of this performance.

Similar explanations might easily account for many of the other supposed displacement activities in which pecking, biting, pulling, or pushing movements are conspicuous.

Discounting such certain or probable autochthonous reactions, at least provisionally, the remaining list of probable or possible displacement activities is very greatly shortened. The majority of the remaining patterns, moreover, are comfort movements such as preening or scratching; just the type of reaction whose causation, whether displaced or not, is most difficult to determine with any degree of assurance. The real nature of many of them, if not all, is still highly dubious.

The fact that real displacement activities are apparently rarer than sometimes assumed is not without significance in connection with the origin of ritualized displays.

Many displays, particularly the most elaborate hostile and sexual performances, contain elements that appear to have been derived and modified from such "extrinsic" or "extraneous" contexts as

sleeping, preening, or nest-building. There have been frequent suggestions that all of these "extraneous" elements must have originated, in the display situation, as allochthonous displacement activities. This theory may be quite correct, but we have very little evidence by which to judge it, and it is by no means the only possible explanation of the presence of these patterns in such peculiar circumstances.

Some of the supposedly "extraneous" elements in certain displays, of course, may be far more apparent than real. They may have been misinterpreted in the same way as some of the supposed displacement activities noted above. The pecking and throwing movements in the hostile and ritualized "choking" threat of the Black-headed Gull, for example, are rather misleading in much the same way as the similar movements in the "grass-pulling" of the Herring Gull (see Moynihan, 1955). They too should be classed as redirected attack, and they must always, therefore, have been strictly "intrinsic" as hostile reactions.

There are other components, however, in this and other displays, whose "extraneous" source is less easily questioned.

The ritualized "mock-preening" movements in the "courtship" of many male ducks (Lorenz, 1952), may be taken as representative of this group. They do seem to have been derived from real preening (although it is just barely possible that they might be modified forms of avoidance intention movements instead).

Assuming that they are indeed derivatives of preening, these movements may have been evolved from what was once displacement (conflict and thwarting are almost inevitable in "courtship" encounters); but such displacement preening, even if it did exist, was probably not the only source available. "Courtship" activities are also likely to provoke a considerable amount of purely autochthonous preening, during the performance itself or immediately afterwards, if only because vigorous activity of any sort is very apt to disarrange the plumage. Such ordinary preening may, therefore, have been the usual accompaniment of "courtship" in the males of the ancestral ducks.

It is extremely probable, moreover, that some conditioning would then result. In other words, the female ducks toward which such "courtship" was directed would then become conditioned to the associated movements, and autochthonous preening would thus acquire a "courtship" valence for them. This, in turn, would probably reinforce the connection between "courtship" and preening in the displaying males; as they would then become conditioned to the fact that preening movements had acquired a signal or symbolic function.

Granted the probability of this connection, it is easy to see that

such associated preening might well become incorporated, by natural selection, into the actual "courtship" itself. (This would be a case of "neurophysiological emancipation," as Tinbergen has used the term. These preening movements, as they became incorporated into "courtship," with increasing ritualization, would be less and less motivated by preening drives, and more and more motivated by "courtship" drives.)

This hypothesis is apparently adequate to explain the origin of "courtship" preening in male ducks; and also, perhaps, the appearance of many other display patterns, some of them derived from very different sources, in many other groups of birds.

Some hypothesis of this sort might even seem to be more plausible than the alternative theory that would derive "extraneous" display elements from displacement activities. It might be preferable, primarily, because it is somewhat simpler; i.e. it does not need to assume the existence of some original displacement "spark-over," a type of "spark-over" which may be very rare.

A final point, in this connection, may help to put the matter in perspective.

The exact process by which an "extraneous" pattern is incorporated into a display is certainly difficult to imagine in detail; as we know relatively little about the immediate causal, internal, factors involved in ritualization. There is no reason to believe, however, that the incorporation of an autochthonous "extraneous" pattern would be much more complicated than the incorporation of an allochthonous one. The ritualization of an autochthonous "extraneous" element, in fact, must be essentially the same as that of any other autochthonous pattern in its proper context. The consequences of this basic similarity are obvious. The physical differences between "extrinsic" and "intrinsic" elements are rapidly reduced as ritualization progresses; and this, of course, is the very reason why the two components are so difficult to separate and analyze in many cases.

Summary.—Display behavior patterns, other than vocalizations, seem to have been derived, in varying combinations, from the following sources.

I. Obviously autochthonous and "intrinsic" activities. These are all very similar in basic nature, but they can be rather arbitrarily divided into three major groups.

(a). Intention movements of the drives producing the display.

(b). Higher intensity movements of the drives producing the display.

(c). Redirection activities belonging to the drives producing the display.

II. Apparently "extraneous" activities.

It has been suggested that certain supposedly "extrinsic" or "out of context" elements, very conspicuous in many displays, must have been derived from allochthonous or displacement activities. There is considerable evidence, however, that displacement activities are by no means as common as sometimes assumed, and that the supposedly "extraneous" elements in displays, as a group, are actually heterogeneous and quite varied in origin. Some are not really "extrinsic" at all. They have been derived from purely autochthonous and "intrinsic" reactions, particularly redirection movements; and their physical resemblances to some "extraneous" patterns are purely fortuitous. Many of the really "extrinsic" components, moreover, may have been derived from "associated" activities rather than displacement activities in the conventional sense. That is, they may have been derived from autochthonous patterns of drives other than those producing the display with which they have since been incorporated, autochthonous patterns that often occurred in close temporal conjunction with the ancestral form of the display.

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TYPES OF HOSTILE DISPLAY

BY M. MOYNIHAN

AMONG the commonest social behavior patterns in most birds are a great variety of hostile activities, i.e. behavior patterns produced by attack and/or escape motivation. (The terms "motivation" and "drive" are used interchangeably throughout this paper, in a very broad descriptive sense, as "the complex of internal and external states and stimuli usually or normally leading to a given behavior.")

Hostile activities include attack and escape movements of very different intensities, plus a large number of more complex and obviously ambivalent reactions. The most widespread, frequent, and conspicuous of these complex reactions are the "ritualized" patterns or displays; patterns that have become standardized and specialized as social signals or releasers.

Many hostile displays have been described at length in recent papers; (see, for instance, Bergman, 1953; Goodwin, 1952; Gullion, 1952, 1955b; Hinde, 1952, 1953a, 1953b, 1954; Morris, 1954; Moynihan, 1955a; Moynihan and Hall, 1954; Schaefer, 1953; Simmons, 1951, 1952, 1953; Tinbergen, 1952, 1953, 1954; Tinbergen and Moynihan, 1952; Williams, 1952).

It must be noted, however, that our understanding of these patterns is still far from complete. Some aspects of hostile display in the Passeriformes and Charadriiformes have been analyzed in detail, but other aspects, and other orders, have been studied less thoroughly.

A general discussion and review of our present knowledge might be useful, therefore, as a means of directing attention to some of the major problems that remain to be solved.

All attempts to arrange or classify the various hostile displays must be somewhat arbitrary, in one way or another; but a classification based on functional criteria would seem to be the most nearly "natural" one, and the most convenient for our purposes. These patterns can be divided into four or five main types, according to their usual effect upon the animals toward which they are directed. More precisely, as most hostile displays are commonest during intraspecific disputes, most of them can be classified according to their usual effect upon other individuals of the same species.

A word of caution might be inserted in this connection. Any hostile display may, at any given time, provoke (or appear to provoke) any number of different hostile and/or non-hostile reactions. This "fluidity," which is dependent upon both the internal and external situations of all the birds involved, may tend to confuse the observer;

and it must be stressed, therefore, that the "usual" response to a particular display can only be determined by observing repeated performances of the display at different stages of the annual cycle and in a variety of distinctively different environments.

The commonest types of intraspecific hostile display seem to have been evolved as means of obtaining certain advantages (which may differ considerably in different species at different times) without having to fight for them; thus obviating the risk of physical injury that actual combat would inevitably entail (see Tinbergen, 1952, Moynihan, 1955a, Moynihan and Hall, 1954). This ultimate goal can be achieved, however, by various methods, by reactions whose immediate effects are strikingly dissimilar.

These effects can be listed as follows.

Intimidation.—Intimidatory, or threat, displays are the best known of all the ritualized forms of hostility. They are also the most widespread and abundant; most species of birds having more than one of them.

Their primary immediate function is clear; they are "designed" to make an opponent retreat or flee. They tend to increase both the relative and actual strength of the opponent's escape drive.

(It is possible that some of them, at least, may occasionally stimulate the opponent's attack drive also, to some slight degree; but this subsidiary effect is so relatively weak that its outward expression is very often suppressed.)

The fact that threat displays are "designed" to make an opponent retreat or flee should not, of course, be taken to mean that they are always successful in accomplishing this. Their deterrent value may be shown in other ways. Thus, for instance, threat displays directed toward a particularly aggressive opponent, such as a territory-owner on its territory, will seldom induce an actual escape. They may, however, cause the owner to threaten back, or hesitate, before attacking with full force; and this, in itself, is an indication that even here, in the most unfavorable circumstance, they can produce a "frightening" effect of some sort.

The immediate causation of threat displays, i.e. their motivation, is fundamentally similar to that of all the other types of hostile display. Both the attack and escape drives of a threatening bird are activated simultaneously, and both are activated strongly enough to be expressed externally. (Overt elements of both drives may be visible in the display itself and/or in immediate temporal association with it.) Within this general framework, nevertheless, there can be appreciable

minor differences between the various threat displays of any one species and between those of different species. That is, both the attack and escape drives may differ in actual and/or relative strength in different threat displays (although the motivation of any given display remains relatively constant).

The escape drive may be slightly stronger than the attack drive in some threat displays, and the two drives may be equal in others; but the attack drive is definitely stronger than the escape drive in the majority of the most typical threat displays.

The predominance of attack motivation in most of these displays may help to explain the evolution of their physical form. Threat displays have been derived from many different sources, both hostile and non-hostile (see Moynihan, 1955b); and the most important of the hostile sources would seem to have been a whole series of unritualized and unspecialized "intention movements" or low-intensity reactions. Some of these "intention" patterns were probably locomotory, and others were probably indications of avoidance or retreat; but the great majority of them must have been attack movements such as pecking or pounding with the wings. It is these attack components, moreover, that have been most commonly exaggerated. Many of the morphological structures (releasers) that have been evolved to emphasize the visual conspicuousness of threat displays, to increase their effectiveness as social stimuli, are concentrated around those parts of the body (e.g. bill and carpi) that are most often used as offensive weapons in attacking (see figure 1).

Mimetic Induction.—Any threat display may provoke a threat display in return, very often the same display, in certain particular situations; but some types of threat display have this effect more frequently than others. Compare, for instance, the "Choking" and "Upright" patterns of the Black-headed Gull (*Larus ridibundus*). Both are undoubtedly threat; but the "Choking" induces return "Choking" by the opponent toward which it is directed, much more frequently than the "Upright" induces return "Uprights" (Moynihan, 1955a).

It is not too surprising, therefore, that some hostile displays have become particularly specialized along these lines; e.g. such patterns as the "Yip-reaction" of Jackdaws (*Corvus monedula*), (Lorenz, 1952); the "Curtsying" of Swallow-Tanagers (*Tersina viridis*), (Schaefer, 1953); and the "Piping" of Oystercatchers (*Haematopus ostralegus*), (Makkink, 1942). The infectiousness of these displays has been carried to a quite remarkable extreme; their performance by one

FIGURE 1. Some examples of relatively aggressive threat display postures, apparently caused by stronger attack than escape motivation, in two Old-World jays (after Goodwin, 1952), the Hermit Thrush (after Dilger, 1955), several gulls (after Moynihan, 1955a), and the Sandwich Tern (after van den Assem, 1954).

These postures include strong indications of advance and/or pecking; indications which are probably, in hostile situations, intention movements of attack.

bird almost invariably provokes identical performances by all the nearby birds of the same species (extreme "mimesis," in the sense used by Armstrong, 1951). Their infectiousness seems to be so much greater than that of the other hostile displays occurring during intraspecific quarrels that they probably deserve to be placed in a category of their own. They may perhaps be called "exemplary" displays; as, speaking in purely anthropomorphic and teleological terms, they provide an example to be followed.

Such displays have been found in very few species as yet; and, although others may be found when more species have been studied, their apparent rarity makes it difficult to draw general conclusions about their usual characteristics and significance. This difficulty is increased by the fact that the published descriptions of even the best-known cases are more or less seriously incomplete.

The only partial exception is provided by the Jackdaw's "Yip." Lorenz has shown that this display is a "communal reaction against a social delinquent." It seems to work as follows. If the owner of a nest-hole should find itself successfully attacked at the hole by a particularly aggressive and powerful intruder, it will immediately begin an excited series of "Yip" notes. All the other Jackdaws in the colony will then come over and begin to "Yip" also. This, in turn, will eventually induce the aggressive intruder to give up his attack and join in the general chorus. The physical combat is thus suppressed, apparently by the very infectiousness of the display; but the actual "mechanics" of this achievement, e.g. the changes in motivation of the responding birds, are by no means absolutely clear.

There is some slight evidence to suggest that the other exemplary displays of other species are also used in the communal suppression of overt fighting (or, at least, that they combine this function with more conventional intimidation or appeasement). The published accounts are so indefinite and vague, however, that any hypothesis must remain extremely tentative until these displays have been more thoroughly studied with this particular problem in mind.

The causation and derivation of exemplary patterns, by contrast, are much less obscure—but only because they seem to be much less peculiar. These displays seem to be produced by motivation like that of the least aggressive threat displays; and, as might therefore be expected, they seem to have been evolved from comparable sources.

Appeasement.—Appeasement displays, almost as common as threat, are particularly characteristic of disputes during the reproductive season.

They can be distinguished from both threat and exemplary displays by the fact that they are "designed" to prevent attack without provoking escape or widespread mimesis. They directly reduce the actual and relative strength of an opponent's attack drive; (and also, to a lesser extent, the actual strength of its escape drive).

They are produced, of course, by the usual type of hostile motivation; but the escape drive of an appeasing bird is almost always stronger, usually much stronger, than its attack drive. (A further causal difference between threat and appeasement, in many species, involves the other kinds of motivation which may also be activated simultaneously in the displaying individual. The production of threat displays is sometimes dependent upon the activation of a major instinct, such as the general reproductive instinct, but is comparatively seldom directly dependent upon the activation of "lower-order" drives, such as the sex drive. Many appeasement displays, however, do seem to be restricted or limited in just this way. They are confined, at least, to situations in which the presence of an additional motivation is apparently inevitable. Thus the immediate causation of many appeasement displays, apparently including three or more distinctly different drives, is far more complicated than that of the majority of threat displays.)

Most of the appeasement patterns have also been derived and ritualized from the usual hostile sources; but here again they show a few peculiarities of their own in matters of degree and emphasis. Thus, for instance, the most common and most conspicuous constituents of most appeasement displays are intention movements of escape (see figure 2). These often take the form of avoidance movements; and these, in turn, are often specialized to hide or withdraw the offensive weapons used for attack and, consequently, many of the sign stimuli revealed by threat (see Tinbergen and Moynihan, 1952). Appeasement displays, in fact, seldom reveal structures or colors evolved for appeasing purposes alone; although there are, of course, exceptions to this general rule (e.g. in the Night Heron, *Nycticorax nycticorax*, described by Lorenz, 1938).

The various contrasts between typical threat and typical appeasement, as they have been listed in the preceding paragraphs, might appear to be absolutely and necessarily clear-cut—and so they are in many cases. But it should be noted, nevertheless, that the two types of display are not always incompatible. Appeasement displays are sometimes superimposed upon threat (as in the Black-headed Gull and other Laridae, Moynihan, 1955a). More surprising still, perhaps, is the fact that threat and appeasement may even seem to

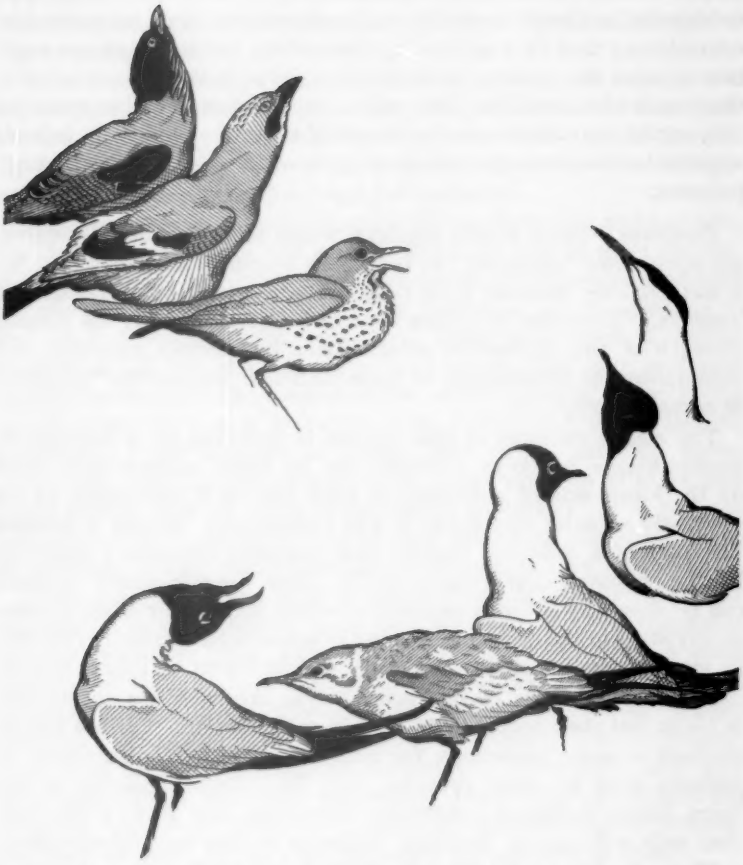

FIGURE 2. Some examples of relatively non-aggressive threat and appeasement display postures; behavior patterns which seem to occur when the escape drive is approximately equal to, or stronger than, the attack drive.

The postures of the jays, the Hermit Thrush, and the various larids are again drawn after Goodwin, Dilger, and Moynihan, respectively.

All of these patterns include strong indications of avoidance or withdrawal, intention movements of escape.

intergrade occasionally. Thus, for example, the "Anxiety Upright" and "Forward" displays of the Black-headed Gull, which must still be regarded as threat according to the criteria used here, are so weakly intimidatory that they seldom, by themselves, induce an escape reaction of more than low to moderate intensity. It is quite conceivable that weak threats of this kind might be transferred or incorporated into actual appeasement in the course of evolution; and such, indeed, appears to have been the history of some of the so-called "courtship" patterns.

Deception.—Some hostile displays, which may be called deceptive, are apparently "designed" to reduce an opponent's attack drive by a method very different from that of the conventional appeasement displays. They tend to reduce the relative (and probably the actual) strength of the opponent's attack drive by directly releasing and stimulating the performance of some particular non-hostile "friendly" or sexual activity.

The classic example of this process is provided by a reaction in cercopithecine monkeys. Should one of these animals find itself on the losing side of a dispute, or even find itself confronted by an obviously superior opponent, it will immediately assume a posture like that of a soliciting female, thus releasing copulatory behavior by the opponent (Zuckerman, 1932). This "pseudo-sexual" posture can be shown by juvenile monkeys of either sex, and by adult females at any stage of the oestrus cycle; and it seems to be extremely effective in averting or controlling the most violent forms of actual attack.

Deceptive displays of this general type are such less spectacular in birds, but they probably do exist in some species. Certain hostile displays of some passerines, for instance, are partly reminiscent of patterns used in social preening, e.g. the "Ruffle" display of the Spice Finch, *Lonchura punctulata* (Moynihan and Hall, 1954); and they may well exert a "soothing" influence by this resemblance alone.

These displays in birds, unfortunately, are not easily recognized as such, and they have been comparatively little studied, even less than the exemplary patterns. It is impossible, therefore, to analyze their evolution or causation in detail. One can only state that they seem to be motivated by stronger escape than attack drive and that they must have been derived, originally, from non-hostile or "extraneous" activities.

This concludes the list of functions subserved by the majority of hostile displays during intraspecific disputes; but there are several

other functions which may be subserved by the same or similar displays in somewhat different circumstances. These latter, rather miscellaneous, may be discussed more briefly. They can be divided into two categories.

Some hostile displays may be used as non-hostile intraspecific signals (and they rarely express antagonism toward the bird or birds for which they are "intended" then). Some of these displays may have a warning function, and others may play a role in sexual recognition or even (conceivably) in sexual stimulation.

Warning displays, including the ubiquitous alarm calls and postures, are the most peculiar of this group. They are usually quite distinct, morphologically; and they seem to have evolved and become ritualized for the specific "purpose" of alerting neighbors and companions to the presence of potential predators. Their motivation is similar to that of all the other displays cited above; but they represent another extreme, in the sense that the attack drive of a bird giving one of these displays is probably at an actual (and often relative) minimum. (This explains, of course, why escape intention movements are usually more important in alarm postures than in any other hostile displays, even appeasement postures.) It is perhaps remarkable, incidentally, in view of their causation, that these alarm displays are as rare during intraspecific disputes as they appear to be.

Other hostile displays, such as many passerine "songs" and their equivalents in other orders, have long been known to be important in pair-formation. The unmated females of many species seem to recognize sexually-motivated males by their performance of certain typically masculine and unmistakably hostile reactions, i.e. certain displays "advertising" the possession of territory. It is possible that these displays may also be attractive in themselves, and they may even have a positively stimulating effect upon the female sex drive; but this would seem to be unlikely on purely theoretical grounds, and such an effect, in any case, has never been proved to exist.

The most interesting aspect of these "advertising" displays, however, is the fact that they are usually displays which function as threat during fights and quarrels. They are usually, indeed, far more common as threat. This would seem to suggest that their evolution must have been controlled, primarily, by their intimidatory role, and that their role in pair-formation has been more or less definitely subsidiary.

The last group of displays includes a variety of patterns which may occur during interspecific disputes and which seem to function as interspecific signals.

Many birds may show threat toward an opponent of another species, but they have seldom evolved displays for this purpose alone. In other words, if a threat display is shown toward an opponent of another species, it is usually, apparently, one of the displays that is more frequently used to intimidate an opponent of the same species. These interspecific threats may seem to be remarkably effective; but, as they are usually interspersed with overt advance and attack movements, if is difficult to determine how much of their apparent effectiveness is due to the displays themselves.

The most elaborate forms of interspecific hostility are certain complicated predator-reactions; i.e. distraction and mobbing performances, both of which can combine unritualized attack and escape movements, apparently "extraneous" activities, and a whole series of displays (see Simmons, 1952). Most of these displays, however, with the exception of some alarm patterns (and, probably, some other less aggressive displays in distraction, which have not yet been properly analyzed), would also appear to be threat of the usual sort. They may occur in peculiar sequences and with unusual orientation in mobbing and distraction reactions; but their actual form would suggest that they too, like most of the simpler performances during interspecific disputes, were originally evolved to induce an intraspecific response.

Summary.—All intraspecific hostile displays (and probably all the interspecific hostile displays also), seem to have been evolved, originally, as social signals subserving the same general function. They enable a bird to obtain certain advantages (which may differ considerably in different species) without having to fight for them. More precisely, they enable a bird to obtain these advantages without being attacked.

Different types of hostile display can subserve this function by very different methods. The principal types of intraspecific hostile display can be most conveniently distinguished by their usual effect(s) upon the birds toward which they are directed. They can be listed as follows.

1. Threat displays. These are the commonest hostile displays. They are "designed" to intimidate an opponent, to make the opponent retreat or flee. They tend to increase both the relative and actual strength of the opponent's escape drive.

2. Exemplary displays. These seem to be much rarer than threat and have been very little studied. Their diagnostic character is their extreme infectiousness. Some of them seem to be "designed"

primarily to release a communal suppression of attack, to stimulate a communal display performance which will "dissipate" attack by an opponent.

3. Appeasement displays. These are almost as common as threat. They are "designed" to prevent attack by directly reducing the actual and relative strength of an opponent's attack drive, without provoking escape by the opponent or any general reaction by neighbors and companions.

4. Deceptive displays. These seem to be as rare as the exemplary displays, and they are also little known. They are "designed" to prevent attack by directly releasing the performance of some non-hostile activity by the opponent.

The causation of all these displays is very similar. They are produced by simultaneously activated attack and escape drives in the displaying bird (with or without the addition of other activated drives such as sex). There is reason to believe, however, that the typical combination, i.e. relative strength, of the two drives is usually different in displays of different types. Most threat, for instance, is produced by more attack motivation than escape, and most appeasement is produced by more escape motivation than attack.

The sources of many of these displays are also very similar. They have been derived from simple locomotory movements, attack movements, escape movements, "extraneous" activities, and calls, alone or in various combinations; but here again the relative importance of these elements is usually different in displays of different types.

Two further categories of hostile display are somewhat anomalous. Some hostile displays may subserve a hostile function during interspecific disputes; and others may have a non-hostile significance in certain particular intraspecific relationships at certain times. Such displays may be rather common; but it is probable that many of them, like the majority of hostile displays in general, were originally evolved to serve as stimuli during intraspecific disputes.

A final point should be emphasized in this connection. The various types of hostile display are neither absolutely incompatible nor always clearly separated. Many birds may alternate several displays very rapidly, or combine two distinctly different displays simultaneously (e.g. superimposing appeasement upon threat). Other birds may produce individual displays which combine two distinctly different functions in themselves (e.g. displays which are partly threatening and partly exemplary). The detailed implications and advantages of such complex interactions, as they occur in different species, can only be revealed by much more extensive and quantitative field studies.

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THE EXPRESSION OF INNATE REPRODUCTIVE RHYTHM UNDER CONDITIONS OF WINTER LIGHTING

BY ALDEN H. MILLER

EXPERIMENTS on the effect of photic stimulation on the reproductive cycle of birds have been particularly extensive in the passerine genera *Zonotrichia*, *Junco*, *Sturnus*, and *Passer*. Recent reviews and summarizations (Wolfson, 1952; Burger, 1953; Miller, 1954) have made it evident (1) that positive light stimulation in these genera will induce gonad recrudescence at rates dependent largely on the daily length of exposure, (2) that prolonged or excessive stimulation will induce and maintain a resting or refractory state, and (3) that the innate rhythmic tendency which these photic stimuli mold into expression consists of required alternation of processes of (a) activation and growth and (b) regression and reorganization. What has not been adequately shown is whether or not the innate rhythmic tendency can reach full expression on a short-day regime. Specifically, will this tendency to resume activity after a normal rest period proceed under a constant light dosage characteristic of the wintertime experience of the species? Some evidence indicates that this will occur, but it is not wholly satisfactory.

Bartholomew (1949) found that in the House Sparrow (*Passer domesticus*) the males would attain full reproductive state on a constant 10-hour day, but the experiment was started on January 23, which is later than ideal in relation to the normal annual cycle, and the birds were pretreated with an 8-hour day, the exact effects of which are uncertain. Moreover the 10-hour period is slightly longer than the effective mid-winter day length at the latitude where the birds were taken. Burger (1953) found that males of the Common Starling (*Sturnus vulgaris*) attained full reproductive state after 16 weeks of constant 9½-hour days, but again this experiment was begun after the winter solstice, on February 2. Burger goes on to comment (p. 2) that it "does seem necessary to demonstrate experimentally for many more species whether or not short days permit a normal reproductive periodicity. . . . It remains . . . to be seen whether or not starlings reared and kept for several years under short days might develop a self-regulating cycle of an annual or non-annual character."

The experiment herein reported on Golden-crowned Sparrows (*Zonotrichia coronata*[1]) was designed to show the capability to re-

[1] The name for this species is properly *atricapilla*, but to avoid confusion in the physiologic literature, the more familiar *coronata* is employed.]

crudesce in males in the absence of photic stimulation greater than that normally received on December 21. The housing and care of the birds at Berkeley, California, was similar to that in previous experiments on this species (Miller, 1948, 1954) except that the experimental cage was darkened with plywood panels and roofing paper and was provided with a light-tight ventilating system. The temperatures in the experimental and adjoining control cages, both situated out-of-doors, differed no more than 4° C on warm days and normally not this much. There was of course greater daily fluctuation in temperature and wind sweep in the control cage. The experimental cage was totally dark except when the lights were on for a 10-hour period each day. During this 10-hour period on alternate days the door panel was opened several hours to permit entry of natural light. The 10-hour regime was set to coincide with the normal interval between awakening and quiet roosting in a local flock of wild Golden-crowned Sparrows on December 21, 1953. The experiment was begun on this date following a normal fall rest period experienced either entirely in the wild or partly in outdoor cages.

The experimental procedure was maintained until the last autopsy on September 20, 1954. Data on the condition of the testes were extended by laparotomy of some individuals. This operation on experimentals and controls had no detectable influence on the health or gonad response of the birds. Laparotomy permitted measurement of the testis and approximate calculation of its volume. Nine records on six experimental birds were obtained from May 1 to September 4. Six control readings were combined with those of previous years derived from the same cage to show the normal cycle of testis increase and subsequent regression (fig. 1).

The helpful assistance of Robert I. Bowman in the conduct of the experiment is gratefully acknowledged.

Results.—The testes in the experimental birds quite evidently never attained functional condition. The curve for size of the testis shows a partial enlargement, slightly but significantly above that of minimum winter condition and above that of birds of previous years experimentally maintained in a refractory condition (Miller, 1954, fig. 1). This slight enlargement prevailed somewhat erratically from May through August, but it was most evident in June and July when volumes of 4.05 mm.^{3} were recorded. These however are to be compared (fig. 1) with volumes of 191.65 and 222.52 mm.^{3} in controls in these same months and 1.00 mm.^{3} or less at winter minimum.

The maximum histologic development reached was stage 5 of Blanchard (1941) in which primary spermatocytes in synapsis are

abundant, but the manifestation of stage 5 was atypical in that Leydig cells in the spaces between tubules were noticeably less in numbers than normal for this stage. In any one interstice up to three enlarged Leydig cells could be seen whereas normally many of the interstices contain two or three times this many. Such a testis in an experimental bird was examined from an autopsy of May 1. On June 12 a testis that had apparently reached this same condition was regressing; there were degenerating synaptic primary

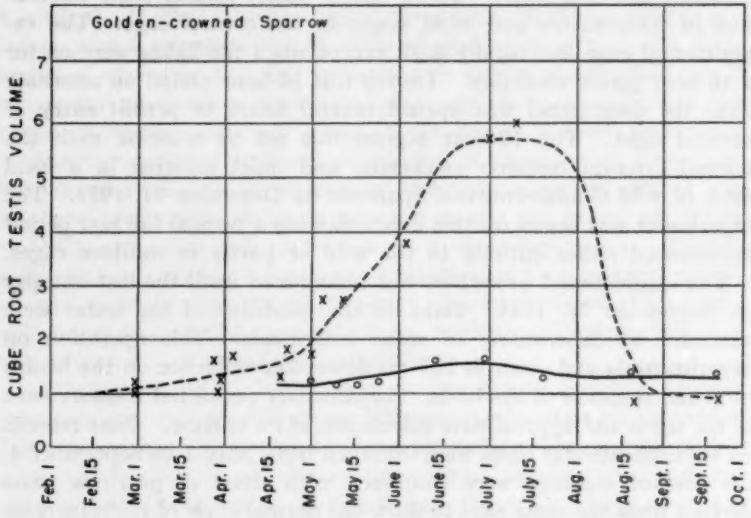

FIGURE 1. Testis volume, in millimeters, of Golden-crowned Sparrows. Broken line and X's represent controls from several years. Solid line and circles represent experimentals held in 10-hour cage from December 21, 1954, to dates of autopsy.

spermatocytes, still with dense chromosome clusters, in the lumina of the tubules and no sign of later stages such as spermatids and sperm; active Leydig cells were absent. On June 30 a testis that had attained stage 4 or 5 was just beginning to regress by break down of synaptic primary spermatocytes; Leydig cells were present in limited numbers as in the bird of May 1. Histologic samples of July 20 and September 20 were in stage 2 with no sign of sex cells advanced beyond the spermatogonia; there were occasional rather small Leydig cells such as may be seen in an inactive testis. Presumably these two had regressed from partly activated conditions like those just described. The controls in June and July were of

course in stage 7, but those of late April and early May were in stages 4 and 5.

Experimentals showed large deposits of subcutaneous fat from June 12 to September 20, but not in May. Controls showed conspicuous fat in May correlated with testis stages 4 and 5 but only moderate fat while in stage 7. Experimentals underwent prenuptial molt in early May but no annual molt (one individual remaining) in August and September. A control underwent annual molt in August.

Included in the experimental cage were three examples of the local, permanently resident race *nuttalli* of the White-crowned Sparrow (*Zonotrichia leucophrys*). This form normally reaches stage 5 by mid-February (Blanchard, 1941) when effective day-lengths for the birds are about 12 hours. Stage 7 is reached by mid-March when days are about 13 hours. The experimental sample is too small to yield conclusive data on *nuttalli*, but on May 1 and 2 these three birds in the 10-hour cage had attained histologic stages 6, 7, and 7, with volumes of 18.39, 134.42, and 167.60 mm.^{3}, respectively. Thus their recrudescence had carried to completion, but whether or not it was on normal schedule is uncertain. The manifestation of stage 6 on May 2 suggests that a very considerable lag may occur under the 10-hour regime.

Conclusions.—In *Zonotrichia coronata* light stimuli above the amounts normal in mid-winter are necessary for the pituitary-gonad mechanism of the male to attain reproductive state. An innate tendency to recrudesce, more or less on schedule, is evident from the partial development achieved. This innate process falls short at the level of stage 5 of the testis, the primary spermatocytes reaching synapsis but failing to proceed with the maturation divisions. Subsequent regression to a resting state occurs while still on a constant 10-hour day. At stage 5 in these experimental birds the number of Leydig cells is abnormally low, which situation probably reflects a low level of the gonadotropins from the pituitary. Inadequate amounts of gonadotropins may also be the factor that stops the maturation processes in the sex cells. Burger (1953: 231) also reports that recrudescence in *Sturnus* on an 8½-hour day proceeds to but not beyond the primary spermatocyte stage.

Preliminary results for *Zonotrichia leucophrys nuttalli* suggest but do not yet prove that mid-winter light suffices in this form for full gonad development although this is probably not achieved with such light on normal schedule.

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Elsie M. B. Naumburg.

IN MEMORIAM: ELSIE MARGARET BINGER NAUMBURG

BY JOHN T. ZIMMER

ELSIE MARGARET BINGER NAUMBURG was born in New York City, where she died on November 25, 1953. She was educated in private schools in that city and later attended Sachs Institute at the University of Frankfort and the University of Munich, Germany. While she was in Europe, her attention was drawn to some of the exhibits of tropical birds in the museums, and she thereupon determined to learn more about them. In this way she came under the distinguished tutelage of Professor Carl E. Hellmayr with whom she studied for several years.

The outbreak of World War I brought her back to the United States. Wishing to continue her ornithological studies, she volunteered for work in the Department of Birds in the American Museum of Natural History, of which Dr. Frank M. Chapman was then Curator in Chief, devoting her attention particularly to the birds of tropical America. In October, 1918, she was formally attached to the staff; she was made a Research Assistant in 1920 and in January, 1924, was appointed a Research Associate, a title she held for the rest of her life.

In 1908, she had married Victor Reichenberger, who died in 1913, and her early publications will be found under her married name of that period. In 1923, she married Walter Wehle Naumburg of New York, who survives her. Her most important and extensive publication was her report on The Birds of Matto Grosso, Brazil, published in 1930 as Volume 60 of the Bulletin of the American Museum of Natural History—a book of over 430 pages with numerous colored plates, maps, and photographs. It was based on the collections made, largely by George K. Cherrie, on the famous expedition to the unknown interior of Brazil by Theodore Roosevelt and Colonel Rondon.

In the meantime, Mrs. Naumburg secured the services of the experienced collector, Emil Kaempfer, whom she employed to collect birds in southeastern Brazil. Until 1931, Kaempfer continued to send back fine series from little-known localities, including many novelties as well as rediscovered and long-lost rarities. Study of these collections was begun and Mrs. Naumburg had issued the first two numbers of a projected series of reports when World War II came to disrupt her plans. She diverted her attention to a multiplicity of relief problems, much of it devoted to the Soldiers' Canteen operated by the Salvation Army of which Mr. Naumburg was a Director. This left her no time to pursue active study of her Brazilian

birds, but she continued to sponsor certain field work and at one time made a brief visit with her husband to Brazil to see the terrain and establish personal contacts with ornithologists in that country.

A short time after Dr. Chapman's death in 1945, she conceived the idea of establishing and building up a memorial to him in the form of a fund for grants-in-aid to younger ornithologists in all parts of the country for projects to be approved by a Memorial Committee; the Fund to be administered by the American Museum of Natural History. She and Mr. Naumburg made the first contribution to this Frank M. Chapman Memorial Fund which, under her active leadership, continued to grow, supplying an income that has already been of material service in the manner and for the purposes for which it was planned.

Mrs. Naumburg's interests extended well beyond ornithological bounds. Of allied significance was the cartography of tropical America, particularly with reference to the mapping of geographical and climatic features that influence the distribution of animals and plants. She served as Chairman of a women's educational committee of the American Geographical Society concerned with the extension of modern geographical knowledge in American schools; a member of the Society of Women Geographers; a Trustee of the National Foundation of Junior Museums, Inc. of Sacramento, California; a Director of the Greenwich (Connecticut) Nature Center; formerly a member of the Board of Directors of the National Audubon Society; a member of the Linnaean Society of New York, the New York Academy of Sciences, and the (N. Y.) Women's City Club. She shared with her husband many of his notable activities and benefactions in the world of music and was Secretary and Treasurer of the Walter W. Naumburg Musical Foundation and Chairman of the Board of "An Hour of Music, Inc."

Her association with the American Ornithologists' Union began in 1916. She was elected a Member in 1924 and a Fellow in 1952. She was a regular attendant at the annual meetings of the Union and, furthermore, took part in a number of the International Ornithological Congresses, including the Tenth, held at Uppsala, Sweden, in 1950.

Her later years were filled with so many and so varied activities that her list of published writings does not accurately express the extent of her unfailing interest in ornithology.

American Museum of Natural History, New York, New York, March 29, 1955.

OBSERVATIONS ON THE AVIFAUNA OF AN OZARK PLATEAU

BY PHILIP S. CALLAHAN AND HOWARD YOUNG

ORNITHOLOGICAL studies in Arkansas, aside from special investigations of single species, have been primarily of a survey nature. Thus, while works covering the state as a whole have been published by Howell (1911), Wheeler (1924), and Baerg (1951), there are only a few published studies of specific habitat regions in Arkansas. Baerg (1927) worked in Logan County, and Smith (1915) and Black (1935) have reported on the southern portion of Washington County. This paper on the birds in an Arkansas Ozarks region may help fill the gap in published information on that area.

This work represents a portion of a thesis submitted by the senior author in partial fulfillment of the requirements for the degree of Master of Science in Zoology at the University of Arkansas. Most of the material on which the discussion is based was gathered during a period extending from June 21, 1952, to May 20, 1953. Field observations were made about once a week (41 trips), each trip lasting about four hours.

The study area was two square miles (T 16 N, R 32 W, Secs. 3 and 4) of wooded, hilly terrain in the northwestern corner of Washington County, Arkansas, on the Ozark plateau. It contains an artificial impoundment, Lake Wedington, formed in 1937. The total surface area of the lake is 81.5 acres (Owen, 1951).

Figure 1 shows the main plant communities of the region. The uplands are covered with rather sterile stands of mixed oak; *Quercus stellata* and *Q. marilandica* lead in abundance, and *Q. rubra*, *Q. velutina*, and *Q. macrocarpa* are the most numerous of the other species represented. These stands are primarily scrubby and quite monotypic, with a scanty understory. This upland oak community occupies about 61 per cent of the study area. The second major community is composed of flood plain species occupying low areas near the lake and along the streams. Conspicuous species in this more varied area are sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), black willow (*Salix nigra*), sweet gum (*Liquidambar styraciflua*), winged elm (*Ulmus alata*), water locust (*Gleditsia aquatica*), bodark (*Maclura pomifera*), persimmon (*Diospyros virginiana*), sassafras (*Sassafras albidum*), redbud (*Cercis canadensis*), buttonbush (*Cephalanthus occidentalis*), grape (*Vitis* spp.), and others. This community occupies about 10 per cent of the study area.

The bulk of the remainder of the land is covered by scattered

plantings of southern short-leaf pine (*Pinus echinata*) and open grassy areas in which "broom sedge" (*Andropogon virginicus*), ragweed (*Ambrosia* spp.), foxtail (*Alopecurus* spp.), and Queen Anne's lace (*Daucus* sp.) are typical plants.

Elevation on the study area varies from 1100 to 1250 feet.

Composition of the Wedington Avifauna.—One hundred and thirty-five species have been reported from the Wedington area, 69 of which are probable breeders (18 permanent residents), 11 of which can best be classified as winter residents, and 55 of which are mainly represented by transient individuals.

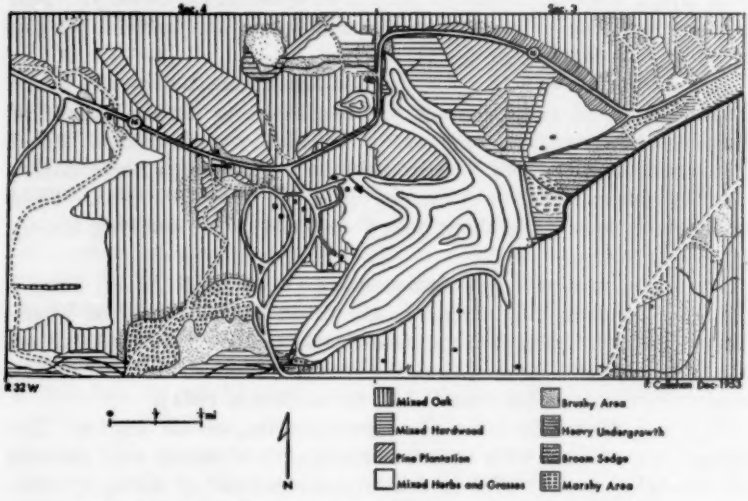

FIGURE 1. The Wedington Area, Washington County, Arkansas.

The techniques of the study did not include any searching for nests, and only a few species were definitely known to be breeding on the study area. Those generally considered as breeders for this region (Baerg, 1951) were so listed. Some difficulty arose in assigning species to any one of the categories listed above, since some forms (e.g., Blue Jay, *Cyanocitta cristata*) apparently include both migratory and sedentary individuals, and in other cases the behavior of a species was irregular. Thus Harris's Sparrow (*Zonotrichia querula*) at times appears to be a common winter resident in northwestern Arkansas, and at other times is not found. All species were eventually assigned to one of the categories; generally speaking Baerg (*op. cit.*) was followed in determining the status.

As in commonly found on such studies on inland areas (Anderson, *et al.*, 1941; Salt, 1953; etc.) the passeriform species were most numerous. Of the 135 species seen, 77 (57 per cent) were passerine. Within this group the Parulidae (18 species) and the Fringillidae (17 species) were the best represented. Among non-passeriform birds the Anatidae with 18 species, all transients or winter residents, making temporary use of the lake, and the Picidae (7 species) were most numerous. A total of 35 families was recorded, with an average of 3.9 species per family utilizing the Wedington area. This small list for a year's observation is typical for the region and is indicative of the generally impoverished fauna of this area. All species common enough to be of ecological significance were observed.

Frequency of Occurrence.—By means of a seasonal breakdown, the relative abundance of various species in the following groups was noted: permanent residents, winter residents, and summer residents. Owing to the rapid shifting of transient populations, a frequency analysis of these species did not seem practical.

The techniques used were similar to those of Linsdale (1928); however, the number seen per hour of observation was used as a basis for comparison. The recommendation of Dice (1930) was also followed, and the frequency comparisons were made on separate habitat lists. This restricted the analysis, since only the flood plain habitat had a varied enough avifauna to make analysis worthwhile. Inasmuch as this habitat was by far the richest in bird life, the inclusion of data from other habitats would not greatly alter the picture. These data are presented in tables 1, 2, and 3; permanent residents are included in all three tables.

The Carolina Chickadee (*Parus carolinensis*) and the Crow (*Corvus brachyrhynchos*) were the species most frequently recorded (table 1). The conspicuousness of these species is matched by other permanent residents, and we feel that the analysis quite accurately indicates their relative abundance. The low incidence of Bobwhite (*Colinus virginianus*) in this particular area had been previously noted by Baerg and Warren (1949).

Table 1 includes data from the entire period of observation. When only the winter period is considered (table 2), there is in some forms a decrease in the average number of individuals seen per hour (e.g., Carolina Chickadee, Crow); in others, such as the Bobwhite and the Robin (*Turdus migratorius*), there are indications of increase. Not all of this can be ascribed entirely to changes in population densities; loss of foliage from trees and bushes and changes in the

activities of the various species would cause unmeasurable variations in their conspicuousness, and therefore in the probability of their discovery during a census trip. Nevertheless, it seems logical to conclude on the basis of these data, that the Flicker (*Colaptes auratus*), for example, is more abundant during the winter in this region than the Red-bellied Woodpecker (*Centurus carolinus*), and in general that the table approximates the relative abundance of the various species. The four most common species here in winter are permanent residents; the most abundant of the species which are present only as winter residents, the Song Sparrow (*Melospiza melodia*), was seen on less than half the winter trips.

Only the summer records are considered in table 3. Here again the relative abundance of the permanent residents is apparent; five of the first six species falling in this category. The Green Heron (*Butorides virescens*), most common of those species present only during the breeding season, was seen only on slightly more than half the summer trips.

Census lists of this sort frequently follow Raunkiaer's Law of Frequency. The fact that tables 1, 2, and 3 do not conform to this distribution is probably a reflection of sample size. The distribution of course will also be influenced by any lack of randomness in the sampling. Preston (1948) gives a detailed discussion of the interpretation of data of this sort. Without going into extensive analysis, however, it is still possible to note certain clear points. All three tables show that those species seen most frequently were generally seen in the greatest numbers. Furthermore, as shown in table 3, where the data are most adequate, those species seldom seen and seen in small numbers greatly outnumber those frequently seen in large numbers. This is a commonly observed phenomenon (Linsdale, 1928; Preston, 1948).

Mallards (*Anas platyrhynchos*) and Lesser Scaup (*Aythya affinis*) were the waterfowl most frequently seen and were represented by the greatest number of individuals.

Habitat Preference.—On every census trip, one hour each was spent in the upland oak and flood plain communities, and one-half hour each was spent in the grassy areas and the pine plantations. These latter two areas were generally unproductive and easily covered, and it was felt that more time spent in them would not have resulted in significant additions to the species observed. Data gathered are presented in table 4 (waterfowl are omitted).

It can be seen that the greatest number of individuals and species

TABLE 1

FREQUENCY OF OCCURRENCE OF PERMANENT RESIDENTS OBSERVED ON WEEKLY TRIPS IN THE FLOOD PLAIN AREA (JULY 6, 1952, TO MAY 9, 1953).

Species	*Per cent frequency of occurrence*	*Average number per hour of observation*
Carolina Chickadee	93.40	3.60
Crow	93.40	2.77
Cardinal	90.00	4.90
Blue Jay	90.00	3.20
Flicker	56.60	.86
Carolina Wren	43.40	.76
Tufted Titmouse	43.40	.56
Downy Woodpecker	33.40	.33
Red-bellied Woodpecker	23.40	.40
Robin	13.30	.86
Hairy Woodpecker	6.60	.10
Belted Kingfisher	6.60	.06
Pileated Woodpecker	6.60	.06
Bob-white	3.30	.26

TABLE 2

FREQUENCY OF OCCURRENCE OF WINTER RESIDENTS OBSERVED ON WEEKLY TRIPS IN THE FLOOD PLAIN AREA (NOV. 1, 1952, TO FEB. 26, 1953).

Species	*Per cent frequency of occurrence*	*Average number seen per hour of observation*
Cardinal	77.00	3.46
Blue Jay	61.50	3.30
Carolina Chickadee	61.50	2.00
Belted Kingfisher	61.50	.69
Song Sparrow	46.10	1.54
Crow	38.40	.69
Slate-colored Junco	30.70	2.07
Flicker	30.70	.38
Downy Woodpecker	30.70	.23
Wilson's Snipe	23.00	.53
Tufted Titmouse	23.00	.23
Carolina Wren	23.00	.23
Robin	15.40	1.46
Bob-white	15.40	1.30
Fox Sparrow	15.40	.23
White-throated Sparrow	7.70	.23
Red-tailed Hawk	7.70	.23
Sharp-shinned Hawk	7.70	.07
Pileated Woodpecker	7.70	.07
Harris's Sparrow	7.70	.07
Red-bellied Woodpecker	7.70	.07

TABLE 3

FREQUENCY OF OCCURRENCE OF SUMMER RESIDENTS OBSERVED ON WEEKLY TRIPS IN THE FLOOD PLAIN AREA, JULY 6, 1952, TO SEPTEMBER 28, 1952, AND MARCH 26, 1953, TO MAY 9, 1953.

Species	*Per cent frequency of occurrence*	*Average number seen per hour of observation*
Carolina Chickadee	69.23	2.62
Cardinal	61.54	2.23
Blue Jay	61.54	2.31
Green Heron	53.85	.77
Red-bellied Woodpecker	53.85	.62
Crow	53.85	1.46
Belted Kingfisher	46.15	.69
Phoebe	46.15	.92
Catbird	46.15	1.31
Field Sparrow	46.15	2.77
Mourning Dove	38.46	.54
Chimney Swift	38.46	1.77
Red-winged Blackbird	38.46	1.92
Blue Grosbeak	38.46	1.00
Turkey Vulture	30.77	1.23
Blue-gray Gnatcatcher	30.77	1.15
White-eyed Vireo	30.77	.46
Yellow-breasted Chat	30.77	.54
Indigo Bunting	30.77	.54
Barn Swallow	23.08	.62
Brown Thrasher	23.08	.31
Blue-winged Warbler	23.08	.38
Prairie Warbler	23.08	.46
Great Blue Heron	15.38	.15
Spotted Sandpiper	15.38	.38
Yellow-billed Cuckoo	15.38	.38
Ruby-throated Hummingbird	15.38	.31
Pileated Woodpecker	15.38	.15
Wood Pewee	15.38	.62
Tufted Titmouse	15.38	.77
Carolina Wren	15.38	.23
Wood Thrush	15.38	.23
Red-eyed Towhee	15.38	.31
Cowbird	15.38	.77
Red-eyed Vireo	15.38	.15
Louisiana Water Thrush	15.38	.15
Kentucky Warbler	15.38	.31
Cooper's Hawk	7.69	.08
Broad-winged Hawk	7.69	.15
Whip-poor-will	7.69	.08
Nighthawk	7.69	.62
Flicker	7.69	.08
Red-headed Woodpecker	7.69	.08
Downy Woodpecker	7.69	.15
Kingbird	7.69	.69
Mockingbird	7.69	.08
Robin	7.69	.38
Bluebird	7.69	.23
Black and White Warbler	7.69	.08

occurred in the flood plain community. Although it comprised only 10 per cent of the study area, 57 per cent of the species found occurred in it. As compared to the other areas, the proximity to water and the greater diversity of vegetation, including a varied undergrowth, made this the most heavily utilized habitat in the study region. Field observations indicated that more potential nesting sites and a varied fruit and invertebrate food supply were available to species utilizing this area.

The sterility of the upland oak region (61 per cent of the total area) is shown by the fact that only 37 per cent of the species were found in this habitat. As previously noted, there is little variety in these stands as far as the life form of the plants is concerned, and the undergrowth is scanty. Arend (1948) found that only from 2.5 per cent to slightly more than 3 per cent of the oak forest floor

TABLE 4

SPECIES AND INDIVIDUALS OBSERVED IN FIVE WEDINGTON AREA HABITATS.

Habitat	*Number of*		*Per cent of Total*	
	Individuals	*Species*	*Individuals*	*Species*
Upland Oak	409	43	17.2	37
Flood Plain	1107	66	47.2	57
Grass Areas	254	23	10.7	20
Lake Edge and Marsh	522	25	21.5	22
Pine Plantations	81	24	3.4	21
Total	2373	115	100.0	100.0

in this general region was covered with herbaceous and/or shrubby plants.

There are certain variables present in any field census of this sort, which must be considered in interpreting the results. The data in table 4 are based on sight records, and this eliminates the variable of calls and songs of different volume or frequency. Obviously however, some birds are much more conspicuous than others. Howell's (1951) careful study gives us some measurement of the variability among species in this respect. The extent to which the visibility of any given species would vary from habitat to habitat is less well known; because of the denser brush, observation was most difficult in the flood plain region, so any error in these comparisons would probably tend to lessen the contrast between this and the other habitats.

The most sterile of the habitats censused was that formed by the pine plantations; only 81 individuals of 24 species were recorded there during the entire period of the study. Kendeigh (1945) men-

tions the accumulation of sterile needle-layers under evergreen forests, which are typically poor in food supply. This raw, persistent, and slowly decomposing accumulation of needles, commonly called "mor" by pedologists, was very abundant under the pine stands at Wedington. There was no cover for ground-nesting birds in these stands, and very few ground-utilizing species were observed there. The only birds seen feeding in these stands were woodpeckers.

In table 5 a "coefficient of community" (Jaccard, 1928) is derived by dividing the number of species common to any two habitats by the total number of species found in both habitats. Two areas having identical avifauna would result in a coefficient of 1.00. Reference to this table shows that the most homogeneous populations were those in the mixed oak and flood plain areas. The similarity in life form of the dominant plants in these habitats is possibly of some significance in this respect. The area of herbs and grasses

TABLE 5
COEFFICIENT OF COMMUNITY BETWEEN FOUR WEDINGTON HABITATS.

	Flood plain	*Upland oak*	*Grass areas*	*Pine plantations*
Flood plain	—	.36	.32	.25
Upland oak	.36	—	.21	.32
Grass areas	.32	.21	—	.27
Pine plantations	.25	.32	.27	—

shows in general the least correlation with the other regions and has the most distinctive avifauna. Actually there are only small coefficients between any two habitats, suggesting definite habitat selection by the various species. However, there was very little absolute restriction to specific habitat type.

The Geographic Origin of the Wedington Avifauna.—Mayr (1946) classified the bird fauna of North America into 5 elements, according to their place of evolutionary origin. With reference to the Wedington avifauna, his groups can be roughly summarized as follows:

a. Unanalyzed element—including shore birds, raptores, woodpeckers, and some of the fresh water birds.

b. Pan-American element—hummingbirds, flycatchers, tanagers, and blackbirds.

c. Old World element—including the cuckoos, owls, thrushes, crows, kingfishers, nuthatches, kinglets, and titmice.

d. North American element—including vultures, quail, wrens, mockingbirds, gnatcatchers, waxwings, wood warblers, and emberizine finches.

e. South American element—including the richmondenine finches.

None of these groups is precise; in some cases Mayr was forced by lack of evidence (e.g.—*Icteridae*) to make a tentative assignment to a category; in other cases a group had species in more than one category (e.g.—*Phasianidae*). Nevertheless he was able to show interesting variations in the composition of bird populations from various North American regions, and the analysis is of obvious value.

In applying Mayr's classification to the Wedington area, the data were treated in several ways. Table 6 shows the basic breakdown; it includes all species observed in any Wedington habitat, and the records are drawn from every season. The unanalyzed group includes over a third of the species, and in the case of transients and winter residents, unanalyzed species make up more than half

TABLE 6

WEDINGTON SPECIES FROM VARIOUS GEOGRAPHIC ORIGINS.

	Unanalyzed		*North American*		*South American*		*Old World*		*Total*	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Transients	29	21.5	17	12.6	—	—	9	6.7	55	40.7
Summer Residents	10	7.4	26	19.3	9	6.7	6	4.4	51	37.8
Winter Residents	6	4.4	5	3.7	—	—	—	—	11	8.1
Permanent Residents	2	1.5	2	1.5	1	.7	13	9.6	18	13.3
Total	47	34.8	50	37.0	10	7.4	28	20.7	135	100.0

the total. The largest single component of the Wedington avifauna (21.5 per cent) was unanalyzed transients. Many of these unanalyzed species are among the waterfowl; to make these data comparable to those of Mayr (*op. cit.*), such species were deleted from further analyses.

Table 7 shows the geographic origin of breeding passerine species at Wedington, compared with some areas previously analyzed by Mayr (slightly re-arranged), plus an additional analysis of a Wisconsin avifauna. The table is arranged with the northernmost areas at the top. As Mayr has pointed out, there is a gradual decrease in Old World species as one proceeds from the north to the south. While the Wisconsin and Arkansas data do not fit perfectly in this sequence, neither do they indicate any strong departure from the pattern. The various areas are not completely comparable, since the relative abundance of certain habitat types may affect the composition of an avifauna, aside from latitudinal position. The North American

element is well represented; with the exception of Alaska and Oregon, it forms over 50 per cent of the breeding species, and in Oregon nearly half of the breeding passerines belong to this group. It would require the analysis of additional areas to determine if the decrease of this element to the north and south is real or apparent. A suggestion of a cline is best shown in the distribution of the South American element. The discrepancy of the Wisconsin data in this sequence is explained by the fact that fresh-water marsh areas, which are inhabited primarily by indigenous North American species, made up a large part of the area censused.

Mayr also analyzed various habitats by comparing the number of individuals (breeding pairs) of different species from the various

TABLE 7

GEOGRAPHIC ORIGIN OF THE BREEDING PASSERINE SPECIES OF SEVERAL DISTRICTS OF NORTH AMERICA, IN PER CENT.

Locality	*North American*	*South American*	*Old World*	*Reference*
Alaska	39	3	58	Mayr (1946)
Oregon	47	14	39	Mayr (1946)
Ontario	57	13	30	Mayr (1946)
Wisconsin	65	17.5	17.5	Anderson *et al.* (1941)
New Jersey	63	14	23	Mayr (1946)
Arkansas	57	19	24	This paper
Florida	59	20	21	Mayr (1946)
Sonora	52	27	21	Mayr (1946)

groups. Since a breeding census was not carried on at Wedington, we have no data comparable to his. Differences in the conspicuousness of various breeding species (Howell, 1951) should be taken into consideration in interpreting data such as these.

Analyzing Cruickshank's (1942) data for the New York region, Mayr found that 82 percent of the permanent residents (28 species) were of Old World origin. At Wedington, 13 (81 per cent) of the 16 permanent residents (unanalyzable species excluded) were of Old World origin. In a group of 67 summer resident species (New York) only 8 (11.9 per cent) were of Old World origin. Here the data are again similar, 6 (14.6 per cent) of 41 analyzable summer residents in the Wedington area being of Old World origin. Of 12 species from the South American element in New York, only the Cardinal (*Richmondena cardinalis*) was considered a permanent resident. The same species was the only permanent resident among the 10 species of South American origin observed at Wedington. Similarly, Mayr's analysis showed 76 per cent of the Old World element was composed of permanent residents, while only 8.3 per

cent of the North American species were non-migratory. At Wedington, 72 per cent of the species of Old World origin were permanent residents, and 11 per cent of the North American species were permanent residents.

These differences probably reflect the greater resistance of the Old World types to winter conditions, as suggested by Mayr. It is perhaps significant to note that while only 5 winter residents (which bred farther north) were analyzable at Wedington, all were of the autochthonous North American group.

The Wedington data in general agree very well with those of Mayr and support his thesis that as far as birds are concerned, a "North American region" is a more accurate zoogeographical term than "holarctic" or "neotropical." However, while Mayr tends to minimize the error resulting from the elimination of unanalyzable species, the authors feel it is sufficiently great to recommend caution in considering these data. For example, of all Wedington species observed, 35 per cent were unanalyzable in reference to their geographic origin, including 9 species (about 13 per cent of all breeders) which could be called common breeders.

Summary.—Northwestern Arkansas, in the Ozarks region, has a rather impoverished avifauna. Though birds are present in considerable numbers during the height of the migration seasons, there are only 18 permanent residents and 69 breeding species recorded for the Wedington area. This reflects the fact that the greater portion of the region (61 per cent of the study area) is covered by a relatively sterile upland oak association. The birds are most concentrated in the flood plain communities of river bottoms and valleys. While habitat selection was apparent, there was scarcely any total restriction to specific habitat types. Permanent residents were the most abundant species, but the greatest percentage of species seen were migrants or uncommon residents. Most were of North American origin.

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SEXING MATURE COLUMBIFORMES BY CLOACAL CHARACTERS

BY WILMER J. MILLER and FREDERIC H. WAGNER

WHILE there is a pronounced sexual dimorphism or dichromatism in some species of the order Columbiformes, in most others there is not. Until recently we have known of no simple and reliable method for sexing living individuals of these latter species. Various techniques which have been used are: observation of slight quantitative differences in the coloration on the head, neck, and breast of the Mourning Dove, *Zenaidura macroura* (Petrides, 1951); slight differences in the contour of the head and neck of the domestic pigeon, *Columba livia*, (Levi, 1941); differences in behavior; and others. For a number of years, sexing by internal examination of gonads (by laparotomy) has been frequently used in the department of Genetics, University of Wisconsin. This is a delicate and time-consuming operation. Iwata (1926) described a method in which differences of the shape of the lips of the vent of *Columba livia* are used to distinguish the sexes. This technique has not to our knowledge been verifiable in this country (Levi, 1941).

The objectives of this paper are three-fold: (1) to describe a simple method for sexing living adult doves and pigeons by cloacal characters and to present data on the reliability of the method; (2) to list the diverse species in which we have tried this method; and (3) to present data from brief experiments which indicate that the development of these characters is under endocrine influence. We believe the method to be quite reliable and as simple to use as the cloacal examination method for sexing ducks (Hochbaum, 1948) or the widely used method of determining the age of birds by the bursa of Fabricius (Gower, 1939).

Acknowledgments.—We gratefully acknowledge the cooperation of Karl Plath, Curator of Birds at the Chicago Zoological Park at Brookfield, and R. Marlin Perkins, Director of the Lincoln Park Gardens in Chicago, for allowing us to examine the doves and pigeons in their collections. William McShan of the University of Wisconsin Zoology Department kindly provided us with hormones for the experiments and gave advice on dosages. Robert A. McCabe, M. R. Irwin, and W. F. Hollander gave advice on preparation of the manuscript. Hugh Wilmar took all photographs.

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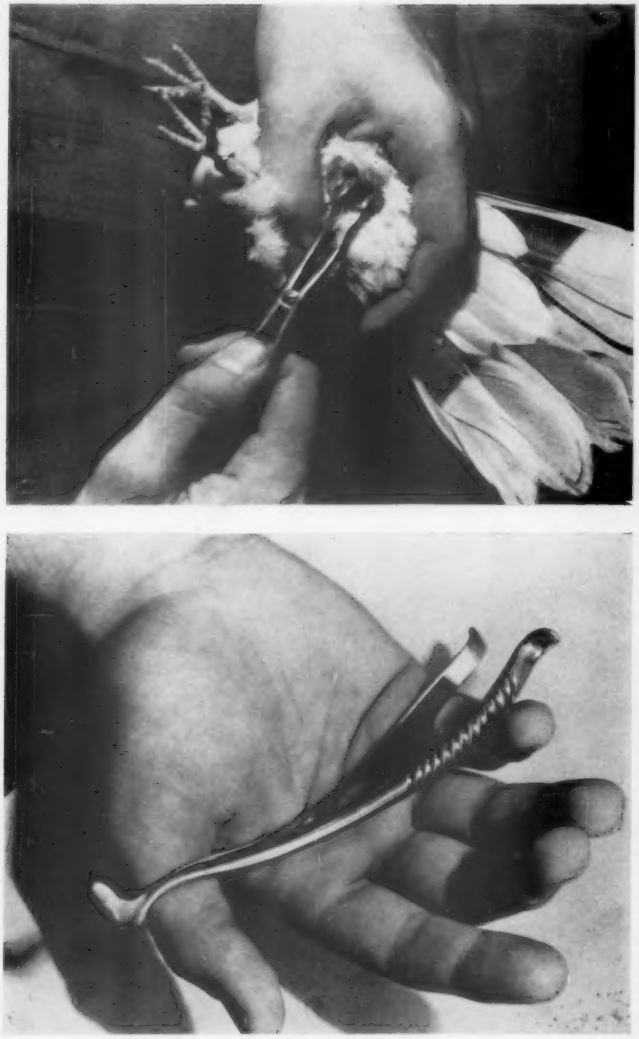
Procedure.—The majority of birds examined belonged to the Department of Genetics of the University of Wisconsin. Additional birds were examined in the two zoos previously mentioned. Most of the Mourning Doves were trapped or collected in the field in southern Wisconsin.

Briefly, the method involves insertion of a modified nasal speculum into the vent to allow identification of cloacal features. The sexing method was suggested by Elwood Briles and first used by Jeff Faust, Foreman in the Department of Genetics, University of Wisconsin. If this method has been used previously, we are unaware of it.

Males possess two conical papillae, one on each side of the cloaca, which terminate the sperm ducts (*vasa deferentia*). Depending on the size of the birds, these papillae vary in length from one to two or three millimeters in the 31 species and hybrids we have examined. They are lacking in females, and the oviduct opening, often of a whitish color, may be seen in the wall of the cloaca on the left side.

The sexing instrument is shown in plate 13. This may be a nasal speculum purchased at a medical supply store. The jaws are ground down on an emery wheel and are three to five millimeters in width and from 17 to 25 millimeters in length. Care should be taken to grind or file the jaws smooth to prevent damage to the cloacal tissue.

For examination, a bird is held under a light, head downward and feet toward the operator. Plate 13 demonstrates this pictorially, although in order to show the insertion of the instrument, the bird is held more horizontally in the picture than it would be in practice. A few small feathers around the vent are plucked. The observer's left forefinger holds back the rectrices and under-tail coverts while the thumb restrains the feathers ventral and anterior to the vent. The head of the instrument is inserted gently to a depth of about one centimeter and directed to the left (to ten o'clock considering the cloaca as a horizontal clock face). The jaws are expanded and at the same time a slight forward and upward pressure (dorsal and posterior to the bird) is applied. This has the simultaneous effects of spreading the lips of the vent, pushing forward (dorsad) the left and slightly posterior wall of the cloaca, and erecting the papilla if the bird is a male. To view the opposite side (not necessary for the sexing process), the instrument is turned in the opposite direction and handled in the same manner. The cloacal structures are shown in plate 14.



The Sexing of Pigeons and Doves. (*Top*) Method of holding bird for examination. (*Bottom*) Modified nasal speculum used for spreading the vent.

The Sexing of Pigeons and Doves. (*Top*) Close-up, showing the cloacal papillae of the male. (*Bottom*) Close-up, showing the oviduct opening of the female.

If the breeding status of the bird is not known, extreme care should be exercised in inserting the instrument, since a female with an egg in the oviduct might be injured. Eggs can usually be palpated, and females during the breeding season should be so examined if there is any doubt.

We were unable to demonstrate the presence of the cloacal papillae or oviduct opening in immature birds. The possibility occurred to us that the development of these characters could be under the influence of the reproductive hormones. To test this possibility, several experiments with recently fledged domestic pigeon squabs (about five weeks of age) were conducted. The birds were of a strain which carried a mutant color gene described by Hollander (1942) and termed "faded" (ST^F). The gene is sex-linked and dominant to the blue bar of "wild type." It forms the basis of a permanent autosexing strain of birds which can be sexed by plumage. The males are predominantly white with dark flecks whereas the females are nearly normal in color. The following experiments involving hormone treatments were conducted with these squabs of known sex.

Experiment 1.—One female was injected in the pectoral muscles daily with 0.25 cc. of testosterone propionate solution (5 mg. of powdered hormone in 1 cc. of Sesame oil). One male was injected daily with 0.5 cc. of estradiol benzoate solution (1.66 mg. of hormone per cc. of Sesame oil). The birds were examined daily for development of the cloacal characters during the 18 days of injection.

Experiment 2.—Two females were implanted with diethyl stilbesterol pellets under the skin of the neck. One male was given daily, intramuscular injections of 0.25 cc. of testosterone propionate of the concentration described in Experiment 1. Injections were continued 13 days. All birds were examined daily during the period for development of cloacal characters.

Experiment 3.—Three males were implanted with diethyl stilbesterol pellets, two birds with two pellets, and one bird with one pellet. The following day, one of the birds carrying two pellets died. The other two were examined daily for 12 days.

Experiment 4.—Two females were injected daily with 0.5 cc. of testosterone propionate with the concentration described above. This is a doubling of the doses previously described. The birds were injected for eight days and examined daily.

Reliability of the technique.—The sex of 132 birds of ten species and a backcross hybrid from a species cross was known either from

previous behavior, sex-linked matings, or breeding activity. Seventeen Mourning Doves (*Zenaidura macroura*) were collected during the course of other work and sexed by this method before internal examination. The sex of 91 per cent (120 birds) of these birds of known sex was correctly indicated by our cloacal method; our detection of the sex of 12 birds (9 per cent) was uncertain, and none was incorrectly sexed. Another group of 203 individuals from 30 different species and hybrids whose sex was not previously known was also examined. It was possible to assign the sex of 188 or 93 per cent of these, while the sex of 15 was uncertain. These details are summarized in table 1.

We believe that some of the birds we examined were immature which may have lowered the success in determining their sex. Since the "pilot" study, several hundred individuals of *C. livia*, *Streptopelia risoria*, and their hybrids and backcross hybrids with other species have been sexed by this cloacal method. Accuracy approached 100 per cent when the birds were healthy and mature.

A number of birds belonging to seasonally breeding species (e.g. *Columba fasciata*, *Z. macroura*, and others) were examined in winter and the cloacal characters described in this paper were recognizable. However, this is not a reliable indication as to whether or not there is regression of the characters in the sexually quiescent season. These birds are housed in a building where artificial lights are frequently kept burning longer than the normal photoperiod for the season. As a result, there is some stimulation of breeding physiology since some individuals show tendencies to breed throughout the year. This aspect should be studied further.

If other areas of the cloaca are examined, occasionally a second set of minute pimple-like processes may be seen in addition to the larger papillae in the males and the left oviduct opening in the females. This is more typical of the larger species, especially *C. livia*. These are apparently the urinary papillae terminating the ureters. They should cause no confusion since they are much smaller than the prominent terminal papillae of the *vasa deferentia* and should not cause one to mistake a female for a male.

Hormone influence.—The results of the experiments with hormones are shown in table 2. It is apparent from the results of Experiment 2 that precocious development of the papillae in the male and oviduct opening in the female were stimulated by androgen and estrogen treatment, respectively. It may also be seen from the results of Experiments 1 and 4 that growth of papillae in the females was

TABLE I

ACCURACY OF SEXING AND LIST OF SPECIES EXAMINED BY CLOACAL METHOD

Species	*Common name*	*Sex known*		*Sex unknown*		
		Correctly Sexed	*Uncertain*	*Sexed as male*	*Sexed as female*	*Uncertain*
Columba fasciata	Band-tailed Pigeon	—	—	0	3	0
Columba guinea	Triangular-spotted Pigeon	—	—	5	5	2
Columba livia	Domestic Pigeon or Rock Dove	35	6	3	11	1
Columba palumbus	European Wood Pigeon	—	—	1	1	0
Columba rufina	Rufous Pigeon	—	—	0	1	0
Columba guinea-livia	Backcross hybrids	26	2	9	5	1
Streptopelia bitorquata	Philippine Turtle Dove	—	—	2	1	0
Streptopelia capicola	Cape Turtle Dove	—	—	8	3	1
Streptopelia chinensis	Pearl-necked Dove	5	0	7	0	0
Streptopelia orientalis	Chinese Turtle Dove	—	—	2	1	0
Streptopelia risoria	Ring-necked Dove	17	0	15	5	0
Streptopelia semitorquata	African Turtle Dove	3	0	3	2	1
Streptopelia senegalensis	Senegal Turtle Dove	2	0	29	9	2
Streptopelia tranquebarica	Dwarf Turtle Dove	7	2	—	—	—
Streptopelia turtur	European Turtle Dove	—	—	0	1	1
Caloenas nicobarica	Nicobar Dove	—	—	2	2	0
Chalcophaps indica	Green-winged Dove	0	1	—	—	—
Gallicolumba luzonica	Bleeding Heart Pigeon	—	—	0	1	0

TABLE I—*Continued*

ACCURACY OF SEXING AND LIST OF SPECIES EXAMINED BY CLOACAL METHOD

Species	*Common name*	*Sex known*		*Sex unknown*		
		Correctly Sexed	*Uncertain*	*Sexed as male*	*Sexed as female*	*Uncertain*
Geopelia humeralis	Bar-shouldered Dove	—	—	1	4	0
Leptotila jamaicensis	Violet Dove	—	—	1	0	0
Ocyphaps lophotes	Australian Crested Dove	—	—	2	5	1
Phaps chalcoptera	Bronze-winged Pigeon	—	—	2	2	0
Phaps elegans	Brush Bronze-winged Pigeon	—	—	1	1	1
Scardafella inca	Inca Dove	—	—	1	0	0
Zenaida asiatica	White-winged Dove	—	—	2	1	0
Zenaida aurita	Martinique Dove	3	0	0	1	0
Zenaidura auriculata	Bronze-necked Dove	—	—	2	0	1
Zenaidura graysoni	Grayson's Dove	2	0	2	2	0
Zenaidura macroura	Mourning Dove	20	1	4	2	2
Ducula spilorrhoa	White Fruit Pigeon	—	—	1	2	1
Goura cristata	Goüra or Crowned Pigeon	—	—	0	2	0
Total individuals		120	12	105	83	15
Per cent		91	9	93		7

TABLE 2

SEX HORMONE STIMULATION OF CLOACAL CHARACTERS IN IMMATURE PIGEONS

Androgen treatment				*Estrogen treatment*			
Experiment	*Sex*	*Length of treatment*	*Results*	*Experiment*	*Sex*	*Length of treatment*	*Results*
1	♀	8 days	2 large papillae	1	♂	21 days	no change
2	♂	5 days	2 papillae	2	♀	6 days	oviduct opening apparent
4	♀	7 days	2 papillae	2	♀	13 days	oviduct opening apparent
4	♀	7 days	2 papillae	3	♂	43 days	no change
				3	♂	43 days	no change

stimulated by androgen injection! However, two efforts (Experiments 1 and 3) to induce growth of oviduct openings in the males by estrogen treatment were unsuccessful.

It is not within the scope of this paper to discuss other aspects of these cloacal characters such as the embryological. However, our findings of the relationship of these characters to their respective sex hormones further confirms the reliability of their use in distinguishing the sex of adult members of the order Columbiformes.

Summary.—Conical papillae terminating the *vasa deferentia* are situated on each side of the cloaca of males of 30 species of Columbiformes. These are lacking in females which have a left oviduct opening. These characters formed the basis of a simple sexing method which allowed sexing accuracy well above 90 per cent for the species studied. None was incorrectly sexed. Premature development of the papillae both in male and female squabs was stimulated by androgen injection; premature development of the oviduct opening was stimulated by estrogen in the females but not in males.

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THE MOLT OF HUMMINGBIRDS

BY HELMUTH O. WAGNER

FEW details are available about the molts of hummingbirds. When collecting in Mexico, I was struck by characteristic variations in the sequence of shedding the rectrices, and this led me to take notes on the sequence of the molt in birds which had been killed. It was possible only in the case of a few species to obtain the number required to describe the whole process in detail. Only freshly killed birds were examined; skins are useless, as the feathers have often dried up in blood quills and are no longer recognizable as such, and it is frequently difficult to find where feathers are missing. Old feathers fade considerably, and by this means they can be distinguished during the molt from new ones. The figures show symbolically the age of each feather: those which have been molted are represented by a trabecula, and those freshly replaced by the whole feather and blood quill show the actual proportion of the enclosed and open parts.

A complete annual molt is the rule with hummingbirds. Exceptions can occur with females which have just begun a new brood at the onset of the molting period and then wear their plumage for two years.

Renewal of the feathers takes place approximately within 60 to 70 days. It is not possible to make more precise statements with killed birds, as within a population there is considerable variation among individuals in the time of onset of the molt. The wings may show remarkably large gaps for birds which depend on their ability to fly as much as hummingbirds do. This, however, does not seem to be very detrimental to those which are molting, as at least some species undertake distant migrations when the primaries are still in blood quills, for example the Rivoli Hummingbird (*Eugenes fulgens*) and the Calliope Hummingbird (*Stellula calliope*). Replacement of individual feather groups takes place in a definite sequence, but the molt of one group merges with that of adjacent groups. Molting of the flight feathers begins with the primaries. Shedding of the rectrices generally follows when the wing molt is nearly concluded. Examination of a fairly large series of White-eared Hummingbirds (*Hylocharis leucotis*) from the same population showed a considerable range of variation in stage of molt of the primaries at the time the first rectrices were shed. I know of only two exceptions to the general rule, two Red-billed Azure-crowns (*Amazilia cyanocephala*) in which the two center rectrices were shed before any of the remiges. The Lucifer Hummingbird (*Calothorax lucifer*) molts both portions of its flight

feathers at more or less the same time. The molt of the contour feathers usually begins towards the end of the molting of the remiges. The corresponding flight feathers and rectrices on each side are replaced at the same time (figure 1). Shedding of the rectrices can be progressive (figure 2), in groups (figure 2), or practically simultaneous (figure 4).

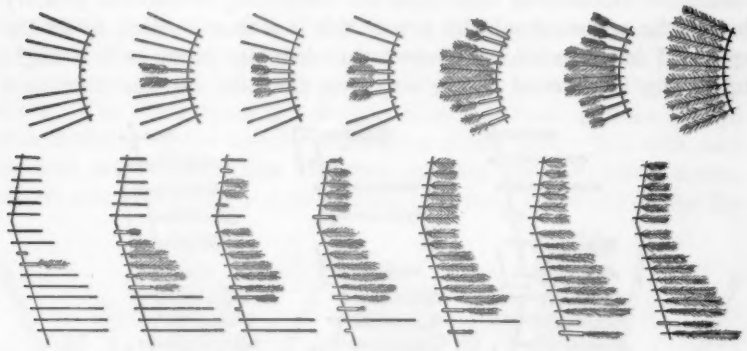

FIGURE 1. The shedding of pinions and rectrices of the Lucifer Hummingbird.

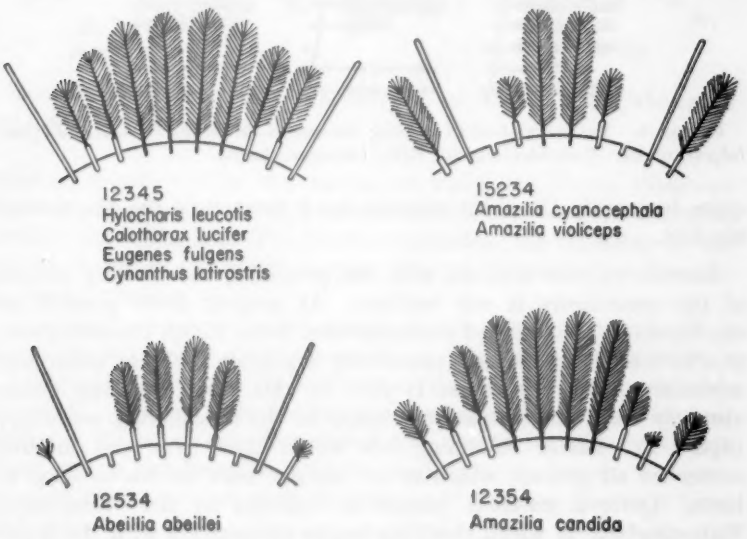

FIGURE 2. Various patterns in the sequence of shedding rectrices. The rectrices are numbered from the central pair (1) to the outer pair (5).

In view of specific differences in the sequence of the molt, it seems advisable to discuss the molting areas individually.

Primaries.—The molting center of the ten primaries in the Lucifer Hummingbird is situated between the seventh and eighth pinions and hence is not central (figure 1). Owing to this, the outermost pinions, charged with the main effort of flight, are renewed after the remainder has already been replaced. Shedding of the first primary before the second should be noted; this is a characteristic of all the species I investigated. However, this does not occur as one might expect by the second falling out after the first one has hardened;

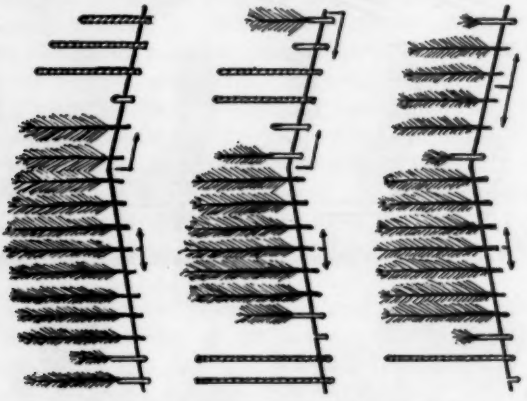

FIGURE 3. Variously situated molting centers of secondaries. Left. *Eugenes fulgens;* middle, *Hylocharis leucotis;* right, *Calothorax lucifer.*

quite frequently the third assumes for a short time the function of the first.

Secondaries.—In contrast with the primaries, the molting process of the secondaries is not uniform. At present three possibilities are known. The simplest process is seen in the Rivoli Hummingbird, in which replacement runs proximally beginning with the outermost secondary. My impression is that in this case, shedding passes abruptly from the innermost primary to the neighboring secondary (figure 3). Rivoli Hummingbirds would then have one molting center for all pinions, which so far has not been known to occur in birds. Quite a different pattern is followed by the White-eared Hummingbird, in which shedding begins successively with the innermost and outermost secondaries (figure 3). Replacement of the six feathers in this way is more rapid than in the Rivoli Humming-

bird. The same applies to the third sequence exemplified by the Lucifer Hummingbird, in which shedding begins between the third and fourth primaries and progresses proximally and distally in a regular manner (figure 3).

Rectrices.—The rectrices may be replaced in one of four different patterns (figure 2). I am not aware of the occurrence of further methods. From the point of view of development, the oldest is probably the centrifugal process which is found with the Lucifer, White-eared, Broad-billed (*Cynanthus latirostris*), and Rivoli hummingbirds. The other types are derived from this basic pattern, except that shedding of the outermost rectrices occurs first. The fifth may be shed immediately after the first, as with the Red-billed Azure-crown and Black-billed Azure-crown (*Amazilia verticalis*) or as the

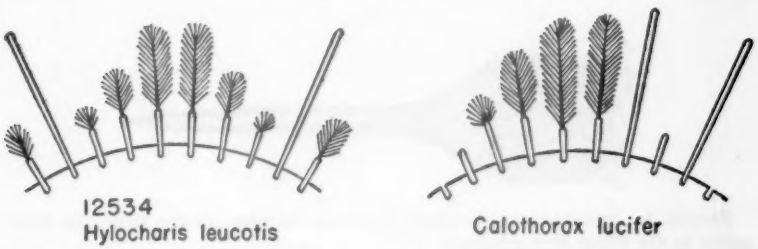

FIGURE 4. Exceptional patterns of shedding the rectrices in the White-eared and Lucifer hummingbirds.

third in sequence after the second, of which the Green Violet-ear (*Colibri thalassinus*) and the Emerald-chinned Hummingbird (*Abeillia abeillei*) are examples. The fourth possibility, the shedding of the outermost before the fourth, occurs with the White-bellied Emerald (*Amazilia candida*).

As already mentioned, replacement of the corresponding feathers occurs on both sides simultaneously. An exception was shown by a Lucifer Hummingbird which had lost its rectrices asymmetrically (figure 4). On one side the normal, centrifugal process occurred, while on the other side the second and fourth feathers remained. These, which had been left over for some unknown reason, had presumably been replaced only recently and therefore had not been shed again.

The fact that a sequence is not maintained unconditionally within a species or even a population is shown by a White-eared Hummingbird from Santa Rosa, D. F., which did not molt centrifugally as

is normal, but on both sides replaced the fifth (outermost) rectrix after the second (figure 4). It is not known whether this pattern, which deviates from the centrifugal type and which is apparently older from a developmental point of view, can be attributed to the appearance of a fresh mutation. I cannot see that either method has any increased value for the preservation of the species.

Plumage other than rectrices and remiges.—Change of the contour feathers, which starts towards the end of the molt of the rectrices and remiges, begins in the tail region, continues over the rump, and ends in the head tract. Occasionally there is considerable shedding at the same time on several parts of the body. As an extreme case, on 10 June 1941, in Siltepec, Chiapas, I took a male Rivoli Hummingbird with a whitish-gray instead of iridescent blue cap to be a species

FIGURE 5. Simultaneous shedding of all cap feathers (in the figure, in blood quills) in the Rivoli Hummingbird.

I did not know. It was only when I held the dead bird in my hand that I realized that the whitish-gray cap owed its coloring to blood quills of uniform length which were about to open (figure 5).

Owing to insufficient material, no rules could be established for the time of replacement of the wing coverts. Although generally this was more or less simultaneous with that of the pinions, in a White-eared Hummingbird they were replaced only at the time of the head molt. The same applies to the tail coverts. No dependable ratio between the upper and lower was discovered.

Our present knowledge of the molting of hummingbirds permits only a few rules to be established along general lines. To be noted are the different numbers and positions of the molting centers of the pinions and the variable sequence in the shedding of the rectrices. We are inclined to explain these peculiarities, and also the renewal of the first before the second primary, by teleological considerations. A glance at the figures of feathers at very different growth stages shows that these efforts would be purely speculative in character.

No causal explanation is known for the various patterns characteristic of the species. Only the future can show to what extent an increase in our knowledge of the molting characteristics of the individual species can be applied to their arrangement into a natural system.

This work was aided by a grant from the Deutsche Forschungsgemeinschaft.

Übersee-Museum, Bremen, Germany, September, 1954.

THIRTIETH SUPPLEMENT TO THE AMERICAN ORNITHOLOGISTS' UNION CHECK-LIST OF NORTH AMERICAN BIRDS[1]

THE present supplement includes changes in name and status, as well as additional forms, accepted by the Committee on Classification and Nomenclature during the year 1954. The Committee met at the annual sessions of the A.O.U. in Madison and conducted additional business through the circulation of memoranda by mail. The final manuscript for the fifth edition of the Check-List is now being assembled.

As a matter of general interest, the Committee has decided to list common names only for species, and not to give additional common names to the subspecies that may be included under the species headings.

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15. *Hydrobates pelagicus* is omitted, since the supposed records for our limits have proved to be invalid. See Oberholser, Proc. U. S. Nat. Mus., vol. 47, 1917, p. 167, where specimen USNM 94554 is identified as *Oceanodroma leucorhoa;* also Salomonsen, Grønlands Fugle, 1950, p. 563.

28. *Dichromanassa rufescens dickeyi* van Rossem, considered a synonym of *D. r. rufescens* in the Nineteenth Supplement, Auk, vol. 61, July, 1944, p. 443, is recognized again as valid. See Hellmayr and Conover, Cat. Birds Amer., pt. 1, no. 2, 1948, p. 193.

52. *Netta rufina* is transferred to the hypothetical list, since the record for our limits (see Ridgway, Proc. U.S. Nat. Mus., vol. 4, 1881, p. 23) is considered uncertain.

56. *Somateria mollissima v-nigra* Gray, 1856, is to be listed as *Somateria mollissima v. nigra* Bonaparte, from *Somateria v. nigrum* Bonaparte, Comptes Rendus Acad. Sci. (Paris), vol. 41, no. 17 (not earlier than Oct. 22), 1855, p. 661. (Contrées les plus boreales d'Amerique = Kotzebue Sound, Alaska.)

70. *Buteogallus anthracinus anthracinus* (Lichtenstein) becomes *B. a. anthracinus* (W. Deppe), with the same reference. The type locality is restricted to the state of Veracruz. See Stresemann, Condor, vol. 56, no. 2, March 20, 1954, p. 91.

The Twenty-ninth Supplement was published in The Auk, Vol. 71, No. 3, July, 1954, pp. 310–312.

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71. *Haliaeetus leucocephalus washingtonii* (Audubon) becomes *Haliaeetus leucocephalus alascanus* Townsend, as in the Fourth Edition, since Audubon's terms *washingtonii* and *washingtoniensis* are of uncertain reference. See Mengel, Wilson Bull., vol. 65, 1953, p. 150.

80. *Canachites franklinii* becomes *Canachites canadensis franklinii* because of intergradation with the Spruce Grouse. See Aldrich, in Jewett, Taylor, Shaw, and Aldrich, Birds of Washington State, 1953, p. 203.

81. *Bonasa umbellus castaneus* Aldrich and Friedmann. [300*j*.] Condor, vol. 45, no. 3, May 24, 1943, p. 95. (Soleduck River, elevation 1,200 feet, Olympic Mountains, Washington.) Additional subspecies. Olympic Peninsula, south to Shoalwater Bay, western Washington.

87. *Centrocercus urophasianus* becomes *Centrocercus urophasianus urophasianus* through recognition of the following subspecies.

87. *Centrocercus urophasianus phaios* Aldrich. [309*a*.] Proc. Biol. Soc. Washington, vol. 59, Oct. 25, 1946, p. 129. (Fremont, Oregon.) Additional subspecies. Southern British Columbia through central Washington and central Oregon to northeastern California (where intermediate).

97. *Rallus aquaticus aquaticus* becomes *Rallus aquaticus hibernans* Salomonsen, Vid. Medd. Dansk Naturh. For., vol. 90, 1931, p. 360. (Husavik, northern Iceland.) Resident in Iceland; casual in Greenland, the Faroes, and Jan Mayen.

103. *Charadrius dubius curonicus* is transferred to the hypothetical list, since records of occurrence within our limits are uncertain. See Grinnell, Univ. California Publ. Zool., vol. 38, Jan. 30, 1932, p. 318.

140. *Sterna anaethetus melanoptera* becomes *Sterna anaethetus recognita* (Mathews), from *Melanosterna anaethetus recognita* Mathews, Birds Austr., vol. 2, pt. 4, Nov. 1, 1912, p. 403. (Bahama Islands.) From study of the original specimens in Cambridge and London (Wetmore).

171. *Asio otus tuftsi* Godfrey. [366*a*.] Can. Field-Nat., vol. 61, no. 6, Nov.–Dec., 1947 (Feb. 13, 1948), p. 196. (South Arm, Last Mountain Lake, Saskatchewan.) Additional subspecies. Western Canada and United States from Mackenzie, Saskatchewan, and western Texas westward.

178. *Chaetura vauxi tamaulipensis* Sutton. [424*a*.] Wilson Bull., vol. 53, no. 4, Dec. 20, 1941, p. 231. (Rancho Rinconada, along the Sabinas River . . . at an elevation of about 500 feet, in the vicinity of . . . Gómez Farías, southwestern Tamaulipas.) Additional subspecies. Breeds in southwestern Tamaulipas and southeastern San Luis Potosí. Recorded from Fort Huachuca Reservation, Cochise County, Arizona, by Phillips, Wilson Bull., vol. 66, no. 1, March, 1954, pp. 72–73.

183. *Amazilia violiceps ellioti* becomes *Amazilia verticalis ellioti* through change in name of the nominate form, which is extralimital. See Stresemann, Condor, vol. 56, no. 2, March 20, 1954, p. 91.

190. *Centurus carolinus harpaceus* Koelz. [409*c*.] Contr. Inst. Regional Expl., no. 1, pt. 3, Sept. 24, 1954, p. 32. (Matagorda, Matagorda County, Texas.) Additional subspecies. Eastern Texas from Austin and Houston south to the Gulf Coast (Chambers to Cameron counties).

193. *Sphyrapicus varius appalachiensis* Ganier. [402*b*.] Migrant, vol. 25, no. 3, Sept. [Oct. 22], 1954, p. 40, 1 plate. (Unicoi Mountains, 4400 feet, Monroe County, Tennessee.) Additional subspecies. Breeds in the mountains

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from southwestern Virginia through eastern Tennessee and western North Carolina to northwestern Georgia.

205. *Myiarchus tyrannulus nelsoni* Ridgway, becomes *Myiarchus tyrannulus cooperi* Baird, from *Myiarchus cooperi* Baird, in Baird, Cassin, and Lawrence, Rept. Expl. Surv. R. R. Pac., vol. 9, 1858, pp. xxx, 180. (Mexico.) See Deignan, Condor, vol. 51, no. 6, Nov. 22, 1949, p. 270.

225. *Xanthoura* is combined with *Cyanocorax*, so that *Xanthoura yncas luxuosa* (Lesson) becomes *Cyanocorax yncas luxuosa* (Lesson). See Amadon, Amer. Mus. Nov., no. 1251, Jan. 22, 1944, pp. 9–10; Zimmer, Amer. Mus. Nov., no. 1649, Dec. 28, 1953, p. 9.

233. *Parus atricristatus paloduro* (Stevenson). [732*b*.] *Baeolophus atricristatus paloduro* Stevenson, Proc. Biol. Soc. Washington, vol. 53, Feb. 16, 1940, p. 15. (Paloduro Canyon, Harold Ranch, Armstrong County, . . . Texas.) Wooded canyons of Randall and Armstrong counties, Texas Panhandle.

233. *Parus atricristatus dysleptus* Van Tyne. [732*c*.] Auk, vol. 71, no. 2, April, 1954, p. 201. (Texas, Brewster County, 5 miles south of Alpine, at 5,000 feet.) Additional subspecies. Brewster and Jeff Davis counties, Texas.

259. *Hylocichla ustulata clarescens* Burleigh and Peters. [758*d*.] Proc. Biol. Soc. Washington, vol. 61, June 16, 1948, p. 118. (Glenwood, Newfoundland.) Additional subspecies. Newfoundland and southward through adjacent Canada and northeastern United States to the Adirondack and Catskill mountains, New York.

284. *Parula americana pusilla* is considered inseparable from the typical form, which becomes *Parula americana*, since no subspecies are recognized. See Parkes, Ann. Carnegie Mus., vol. 33, April 19, 1954, pp. 165–166.

288. *Dendroica auduboni nigrifrons* of the Fourth Edition becomes *Dendroica auduboni memorabilis* Oberholser, Ohio Journ. Sci., vol. 21, May, 1921, p. 243. (Ward, Boulder County, Colorado.) Breeds from southwestern Saskatchewan and central Alberta, south to the mountains of southeastern California, southern Arizona, and southern New Mexico, south in winter to Guatemala. See Moore, Auk, vol. 63, April, 1946, pp. 241–242.

290. *Dendroica dominica stoddardi* Sutton. [663*b*.] Auk, vol. 68, no. 1, Jan., 1951, p. 28, pl. 1. (Near Freeport, Walton County, Florida.) Additional subspecies. Coastal area of northwestern Florida, from southeastern Santa Rosa County (Milton) to western Bay County (Vicksburg).

307. *Euphagus carolinus* becomes *Euphagus carolinus carolinus* through recognition of the following subspecies.

307. *Euphagus carolinus nigrans* Burleigh and Peters. [509*a*.] Proc. Biol. Soc. Washington, vol. 61, June 16, 1948, p. 121. (Stephenville Crossing, Newfoundland.) Additional subspecies. Breeds in Newfoundland, the Magdalen Islands, and Nova Scotia.

308. *Cassidix mexicanus torreyi* Harper. [513*d*.] *Cassidix major torreyi* Harper, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, March 8, 1934, p. 1. (Chincoteague, Virginia.) Additional subspecies. Coastal region from New Jersey to Georgia; migrant to Florida. (The resident bird of Florida named *Cassidix mexicanus westoni* by Sprunt, Charleston Mus. Leaflet no. 6, Feb. 24, 1934, p. 4, type locality, St. John's River marshes, Indian River County, Florida, is placed with *Cassidix mexicanus major*.)

308. *Cassidix mexicanus monsoni* Phillips. [513*e*.] Condor, vol. 52, no. 2, March

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15, 1950, p. 78. (Near San Antonio, Rio Grande Valley, New Mexico.) Additional subspecies. Southeastern Arizona, north central New Mexico and western Texas (Brewster County) south to Chihuahua.

335. *Passerculus sandwichensis brooksi* Bishop. [542*j*.] Condor, vol. 17, no. 5, Oct. 10, 1915, p. 187. (Chilliwack, British Columbia.) Additional subspecies. Breeds from Vancouver Island and southwestern British Columbia to western Washington; in winter to central Baja California.

344. *Amphispiza bilineata confinis* van Rossem described from Chihuahua is found to be inseparable from *A. b. grisea*, whose range is restricted to México. The following subspecies, formerly considered a synonym of *confinis*, must therefore be recognized.

344. *Amphispiza bilineata opuntia* Burleigh and Lowery. [573*d*.] Occ. Papers Mus. Zool. Louisiana State Univ., no. 6, Nov. 10, 1939, p. 68. (Guadalupe Mountains, Culberson County, Texas; 10 miles east of Frijole, altitude 4,800 feet.) Guadalupe Mountain region, west Texas.

350. *Spizella wortheni* becomes *Spizella wortheni wortheni* through recognition of an extralimital subspecies. See Webster and Orr, Condor, vol. 56, no. 3, May 21, 1954, p. 159.

Seventy-third Stated Meeting

The Seventy-third Stated Meeting of the American Ornithologists' Union will be held October 25 to 30, 1955. All sessions will meet in the Boston Museum of Science, Science Park, Boston, Mass.

Business meetings will be held on Tuesday, October 25. Papers sessions will run Wednesday through Friday, with the principal field trip on Saturday, and informal field trips on Sunday, October 30.

Details about the meeting are contained in a Circular of Information that has been mailed to all members. Extra copies are available from the Secretary, Harold Mayfield, 2557 Portsmouth Avenue, Toledo 13, Ohio. Applications for a position on the program should be in the hands of the Secretary by September 5.

Visitors at Boston will have a wide choice of hotels, and members are asked to make their room reservations directly with these establishments. The annual dinner will be held Friday evening, October 28.

GENERAL NOTES

Mockingbird Attacking Blacksnake.—On February 21, 1953, I was walking through pine flatwoods near Paradise, Alachua County, Florida, at 10:05 A.M. when I noticed a Mockingbird (*Mimus polyglottos*) diving several times to the ground with loud harsh cries. Upon investigation, I saw that the bird was attacking a blacksnake (*Coluber constrictor*) about two and one-half feet long in a sandy clearing. Although instances of Mockingbirds attacking snakes have been reported, there seems to be little information regarding the details of these encounters.

Audubon, in one of his paintings, depicted four Mockingbirds defending a nest from a large rattlesnake. Mrs. Jesse L. Alley (Florida Naturalist **13**: 26, 1939) saw a Mockingbird attack a coachwhip (*Coluber flagellum*) for "at least a whole day." The bird "was lighting on its [the snake's] head and picking it, and then up in the air as quick as a flash." She reports that the snake did not strike once, a phenomonen which I also noticed. Other passerines have been known to attack snakes. C. J. P. Ionides (Ibis **96**: 310–311, 1954) reported having seen a pair of Black-headed Tchagras (*Tchagra senegala*) attacking a bird snake (*Thelotornis kirtlandii capensis*) and a female White-headed Black Chat (*Thamnolea arnotti*) holding a juvenal spotted wood snake (*Philothamnus semivariegatus semivariegatus*) near Liwale Boma, Tanganyika, in 1945. In each case the snake died.

The following is an account taken from field notes. The fight was observed at approximately five yards. The weather was clear and warm, the temperature being 72° F. at 8:30 A.M. as reported by the weather station at the University of Florida. It is impossible to say how many times the bird had dived before, but after observation began it flew down at the snake 18 times without alighting on the ground. The bird's path was an arc between a wax myrtle bush (*Myrica cerifera*) and a limb of a long-leaf pine (*Pinus palustris*) about 25 feet from the ground, a distance of approximately 20 yards. Each time the bird dived, it continued its flight and alternately alighted on the pine tree or the wax myrtle. It stopped to perch after each trip, remaining at rest from 20 seconds to 2 minutes 10 seconds, the whole 18 trips lasting 13 minutes. On the nineteenth flight, the bird did not attack but flew from the myrtle to the pine tree.

The snake remained motionless during an attack, and bodily contact was not apparent. As long as the snake remained still, the bird did not attack, but as soon as there was movement, the aggressive response was initiated. During the longest interval noted above, the snake remained almost completely motionless.

Now began a most interesting performance. The Mockingbird flew to the ground, alighting about three feet in front of the snake. It flashed its wings two or three times and moved to the right about two feet, always facing the snake; then to the left about four feet, flashing its wings from time to time and emitting loud chirps much in the manner that males do during the breeding season when facing each other in a "combat." The bird made these sidewise runs to the right and left seven or eight times with wings flashing constantly. The snake moved towards the bird several times as if to pass rather than attack. Each time that this occurred, the bird retreated always keeping the three-foot distance.

Now the bird began to circle in a counter-clockwise motion, with wings flashing and the distance between it and the snake remaining about the same. One complete circle was made without an attack, but as the bird began the second circle, it lunged from the left of the snake, pecking it about six inches from the head. It retreated and stood still, cocking its head from side to side.

At this moment, the snake crawled swiftly away indicating that it was far from

moribund as at first suspected. With this maneuver, the bird flew and lighted on the snake pecking it ferociously several times, and then it flew to the myrtle. Almost immediately, it approached again and alighted on the snake near the neck region which it pecked repeatedly. The snake made writhing motions but did not attempt to move away. The bird then began making its back and forth path before the snake, but now running in and pecking the snake's head, then jumping back about a foot. At no time did the snake strike at its opponent. It always moved towards the bird, but it seemed as though it were trying to pass rather than to attack. The bird repeated its vicious head attacks for about 12 minutes and then flew into the pine tree.

The snake, apparently none the worse for its experience, moved swiftly away. I attempted to collect it, but was hindered by the most unusual aggressiveness of the Mockingbird. This individual flew at my head several times, while the snake disappeared into a clump of saw palmetto (*Serenoa repens*).

The fight from the time observations began, lasted 33 minutes, and it is quite possible that it would have continued for a considerable length of time. Courtship posturing occurs in early February, but breeding somewhat later. No nest was found, and the bird was not collected.—THOMAS W. HICKS, *University of Florida, Gainesville, Florida.*

Apparent Copulation of Baldpate in Central Massachusetts.—On March 13, 1954, we observed a pair of Baldpate, *Mareca americana*, in apparent copulation on North Hadley Pond, North Hadley, Massachusetts. As we approached the pond four Baldpate flew off. We remained quiet as the birds circled overhead several times. One pair landed in open water about 300 yards from us, giving us an excellent view with 7 × 50 binoculars and a 20× spotting 'scope. While we watched, the male bird swam up behind the female, pumping his head and neck up and down in a manner similar to the Gadwall's action described by Wetmore (Auk, 1920, **37**: 241). He quickly mounted her, forcing her entire body and head under water. Her head appeared above the surface two or three times during the brief period in which we assume copulation took place. This observation differs from the unusual action described by Hambleton (Auk, 1949, **66**: 198) in that the male did not grab the female's tail in his bill and the female was completely submerged for two or three short intervals during the activity. Further, the date of our observation is a full two months before the May date on which Hambleton's observation was made in Toronto.

In view of the statements in Kortright (The Ducks, Geese and Swans of North America, 1942, p. 187), Bent (U. S. Natl. Mus. Bull. 126: 90), and several of the better-known "state" works to the effect that Baldpates arrive unmated on their breeding grounds, this observation of apparent copulation in Massachusetts is of interest. Our observation might be interpreted in one or more of five ways: (1) that it was merely a behavioral pattern associated with the courtship performance but not culminating in actual copulation; (2) that at least some Baldpate are paired on arriving at the nesting site; (3) that the Baldpate copulates over a long period of time and may be more promiscuous than other anatids; (4) that this pair may be preparing to nest nearby; (5) that it was an abnormal reflex set off by our disturbing influence. It is of course apparent that all five of these possibilities are in the nature of very tentative hypotheses.—L. M. BARTLETT (*Dept. of Zoology*) and GERRY ATWELL (*Dept. of Wildlife Management*), *University of Massachusetts, Amherst, Massachusetts.*

Barn Owls with Two Broods of Young.—Observations are herein presented of nesting activities of a pair of Barn Owls (*Tyto alba*) in the vicinity of Davis in northern California. Two nests were made during their breeding season. The first egg was probably deposited in late December of 1953, and the first egg of the second clutch was deposited during the latter part of March or early April of 1954. Reports dealing with other areas clearly indicate that nesting is not necessarily confined to any season. In view of this fact, it is probable that continuous breeding throughout spring and summer by individual pairs may not be uncommon. Stewart (Auk, 69: 227–245, 1952) cites a record of a banded "female taken from a nest with five young at Hunt's Point, New York, on July 27, 1939, and captured four months and eight days later (December 5, 1939) from a nest with three young at the same place." Although this may indicate continuous breeding, it may also represent late fall and normal spring breeding.

The nesting site of the owls at Davis was located in an old wooden building which had been used to house a water tank on the second floor. Four small (1 × 2 foot) vents below the eaves of the roof provided entrance for the owls. The empty water tank (approximately 4 feet high and 8 feet in diameter) was partially covered by a galvanized iron lid so that a "quarter moon" opening into the tank was formed. The owls' first nest was located on top of this lid; the second nest was inside the empty tank.

The first nest was observed January 8, 1954. At this time two adults were seen and four eggs were found. In early February the nest was revisited and three young were observed; one egg was unhatched. Later in the same month one of the downy young was found on the ground floor of the building. It had apparently fallen from atop the tank lid and through a trap door opening to the first floor. It was left unmolested inasmuch as it was quite accessible to the adult owls through the trap door opening and an open window. It was found dead the following day.

On April 10, the nest was revisited. Two adults flushed: one from the top of the tank, and the other from within the tank. One young bird was dead (on the floor at the base of the tank), and the other was almost fully fledged but unable to fly. On this date the second nest was observed with three eggs in the bottom of the tank. The unhatched egg of the previous clutch was still on top of the tank lid with the young owl. Several fresh, decapitated gophers (*Thomomys bottae*) were also observed on the tank lid amid hundreds of owl pellets. At this time the remaining young owl was removed. The nest was again revisited May 5, and as before, two adults flushed, one from the top of the tank and the other from within the tank. The nest in the tank now contained four warm eggs. One of these was taken and opened. A live well developed embryo (ca. 13 days incubation) was found.

On May 31, the nest was again revisited and two downy young, one slightly larger than the other, were observed. The third egg was not found. During the latter part of June the young were found to be nearly fully fledged, and the nest was found empty on July 25.

From the evidence presented it seems clear that one pair of Barn Owls nested twice during their breeding season which began during December 1953 and lasted until June 1954.—G. VICTOR MOREJOHN, *University of California, Davis, California.*

Ross's Goose in Texas.—During a field trip to the Texas coast in December, 1953, I had occasion, in company with U. S. Game Management Agents Frank Clarkson and Carl J. Gruener and State Game Wardens Clarence Beezley and Bert Cade, to check two crippled geese held by Mr. Dorisse Daigle, 1560 Van Buren Street, Beaumont. One of the geese was a Lesser Snow Goose (*Chen hyperborea hyperborea*);

the other was a Ross's Goose (*Chen rossii*). The latter bird was crippled by Mr. Daigle on the George Bauer ranch in Jefferson County, between Hamshire and China, Texas.

On January 3, 1954, U. S. Game Management Agent Robert S. Bach checked a hunter on Lissie Prairie near Eagle Lake, Colorado County, Texas, who had bagged a Ross's Goose. State Game Warden Tom Waddell obtained the bird and had it mounted.

Kortright (The Ducks, Geese and Swans of North America, 1942, pp. 147–148) lists California as the wintering ground for the Ross's Goose, and so far as I know these are the first records of this species from the Gulf Coast of Texas, although it has been reported from Colorado, Arizona, and Cameron Parish, Louisiana. Other Ross's Geese may have wintered on the Texas coast last year, for our Texas U. S. Game Management Agents received several reports from waterfowl hunters concerning diminutive snow geese. Mr. Daigle donated the crippled birds to the San Antonio Zoo.—RAYMOND J. BULLER, *Assistant Regional Supervisor, Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico.*

A Record of the Mexican Crossbill (*Loxia curvirostra stricklandi*) from Fort Worth, Texas.—Occurrence of any species of crossbill in Fort Worth, Tarrant County, is previously unknown. On May 17, 1954, Sister St. Andrew found a dead Red Crossbill on the grounds of Our Lady of Victory College located in the southern part of the city. Although the ants had slightly eaten the head, I was able to make a study skin of the specimen which proved to be a dull, yellow-colored female. Examination of the body did not reveal any abnormalities, and death was attributed to natural causes.

The skin was forwarded to Allen J. Duvall of the U. S. Fish and Wildlife Service who identified it as the Mexican Crossbill (*Loxia curvirostra stricklandi*). The specimen is now No. 458021 in the U. S. National Museum. Griscom in his Red Crossbill monograph (Proc. Boston Soc. Nat. Hist., **41**, 1937: 135) mentions the occurrence of this race in Texas on the basis of a June sight record of a small flock in the Chisos Mountains. He goes on to state that identification of any race by sight is purely conjectural. So far as known to me, the Fort Worth specimen is the first authentic record of the Mexican Crossbill for the State of Texas.

Sight records of the Red Crossbill were also reported from the Turtle Creek area of Dallas, Dallas County, about 32 miles east of Forth Worth by Mrs. T. E. Winford (*in litt.*). Five birds, reported to be two males and three females, were observed by various members of the Dallas Audubon Society from March 21 to 25. This appears to be the only other report of crossbills in nearby areas for the spring of 1954.

I am sincerely grateful to Allen J. Duvall for his subspecific identification of this specimen.—WARREN M. PULICH, *2720 Frazier Ave., Fort Worth, Texas.*

The Identity of *Pyrrota valeryi* J. and E. Verreaux.—Zimmer (Amer. Mus. Novit., 1304: 15, 1945) discussed a suggestion made by James Bond (*in litt.*) that this bird, now known as "*Tachyphonus valeryi*," might in reality be the troupial *Lampropsar tanagrinus* and concluded that, pending a critical study of the type and paratype, Bond's suggestion should be followed. On June 14, 1954, I was able to study the type and paratype (catalogue numbers 7829D and 7829F, respectively, in the Museum National d'Histoire Naturelle, Paris) and to compare them directly with examples of *Tachyphonus rufus* and *Lampropsar tanagrinus*. The type and paratype of *Pyrrota valeryi* differ from males of *Tachyphonus rufus* and agree with

specimens of *Lampropsar tanagrinus* in the form of the bill, the details of scutellation of the tarsus, the width of the remiges, the lack of a white shoulder patch, and the more extensive but duller gloss on the body feathers. They are, as Bond suggested, indistinguishable from *Lampropsar*. Therefore, *Pyrrota valeryi* J. and E.. Verreaux (Rev. Mag. Zool., ser. 2, 7; 351, 1855) should be placed in the synonymy of *Lampropsar tanagrinus tanagrinus* (Spix).—ROBERT W. STORER, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

Suggestions Regarding Alcoholic Specimens and Skeletons of Birds.—Dr. Josselyn Van Tyne (1952, Auk, **69**: 27–33) recently discussed problems related to the preparation of study skins and emphasized the importance of recording accurate and complete data on the bird-skin label. My work on avian anatomy has made me aware of deficiencies both in the labels and the preservation of specimens in "alcoholic" and in skeleton collections. Wet-preserved specimens require considerable storage space; use of such space is not warranted if the specimens are nearly useless for dissection. Specimens without adequate data serve only part of the use to which they could be put.

The need for spirit collections is great. The complete appendicular myology is known for very few genera of birds. The internal anatomy of most genera, and even of many subfamilies, is unknown. The study of one region in many genera, such as has been made by Beecher on jaw muscles, is dependent almost entirely on spirit collections in the larger museums. An understanding of phylogenetic relationships of the larger taxonomic categories can be had only when the anatomy of those forms is known. Furthermore, it is not enough to know the myological formulae of the leg; the total appendicular myology must be known if one is to understand functional as well as phylogenetic relationships.

Alcohol or formalin are most frequently used to preserve specimens, but each has its disadvantages. There is a need for experimentation with other preservatives in order to learn which will give optimal fixation and preservation. Consideration should be given to the use of a modified embalming fluid (see Woodburne and Lawrence, Anat. Rec., **114**, 1952: 507–514). However, phenol slowly decalcifies bone; toluene might prove to be an adequate substitute.

The most important factor in securing adequate preservation, however, probably is the time between collecting the specimen and placing it in the preservative. This interval, especially in the tropics, should be as short as possible. For small birds, one needs only to make a slit in the ventral abdominal wall to permit entrance of the fluid into the body cavity, though use of a detergent may also be desirable to insure penetration through the feathers to the skin. Incisions along the lateral margins of the sternum should be avoided because they cut through the sternal portion of the ribs and the muscles covering them.

Intravenous injection is the best method for insuring rapid and proper preservation, especially for large birds, but this may be impractical in the field. In the absence of this procedure, injection of major muscle masses, the brain, and the orbit is necessary for large birds. The following areas should be injected: breast, arm, thigh, crus, and neck. It may also be desirable to inject the thoracic cavity by passing the hypodermic needle posteriorly along the lateral side of the esophagus. An incision through the abdominal wall should, of course, be made. Incisions in the skin should not be made in any other part of the body.

The specimen should not be skinned nor should the feathers be plucked. Skinning removes or damages dermal muscles; obviously, it is not possible on a plucked bird to determine the relative lengths of primaries, secondaries, rectrices, and alula quills, and the location or absence of the carpal remex and its covert.

Further information is needed on the type of label and writing medium best suited for long immersion in preservatives. A specimen in excellent condition is useless when accompanied by an illegible label.

The following notes apply specifically to the preparation of skeletons so that the maximum use may be made of them. Before preparing the specimen, measurements of wing length (specify "arc" or "chord") and tail length should be made. When the gonads cannot be found, a notation as to plumage should be made: e.g., "gonads not seen; male plumage." Intellectual honesty here, as elsewhere, is taken for granted.

In removing the skin and feathers, care should be taken not to remove also digit II (= pollex) and phalanx 2 of digit III (formerly digit II; see Montagna. 1945. Journ. Morph., 76: 87–113). For large birds, it is advisable either to skin the feet or, at least, to incise the plantar pads of the digits so as to free the flexor tendons from the vaginal sheaths. The tongue, the supporting hyoid bone, and the trachea, including the bronchi, should be preserved intact. The eyeball (for sclerotic plates and for the os opticus), including the orbital portion of the optic nerve, should be saved (see Tiemeier, 1950. Journ. Morph., 86: 25–46). In removing the larger muscle masses covering the humerus and the shoulder joint, the origin of the deltoid muscle (from the scapula and the capsule of the shoulder joint) should be left intact, so as not to remove or damage the os humeroscapulare (little is known about the presence or absence of this bone in the various groups of birds). The patella should also be preserved; this will be insured if the tendons at the knee joint are not removed.

In most instances, the "final cleaning" of the skeleton will be accomplished by dermestid beetles. Experience indicates that the following additional steps should be taken to insure proper final cleaning. The lungs and kidneys should be removed. The thoraco-abdominal cavity should be rinsed out with water to remove excess blood. It is desirable to make an opening between the halves of the furcula to permit a circulation of air through the body cavity. Sawdust should never be used when removing the skin; cornmeal may be used, but it is preferable to use no absorbent agent at all. Because storage and shipping space are ever-present problems, the skeleton may be tied into a loose ball. The skeleton, thus prepared, should not be exposed to excessive heat, i.e., it should not be dried in an oven. While drying, the specimen should be placed in a wire container where it will be protected from flies; dermestids do not like the partially digested meat left by maggots. Needless to say, no preservative should be put on the specimen.

For rare species, where it is desirable to have both a skin and a skeleton, the bones of one leg and one wing may be left with the skin; those of the other leg and wing may be saved with the axial skeleton, including the skull and pygostyle. (Be sure to measure and record on the label the length of the tail *before* removing the pygostyle.)

Preparation of durable labels in the field presents a problem. Labels prepared with pencil or "indelible" ink may become illegible after a period of blowing about in the wind in inclement weather. Labels should be tied around bones whose configuration will prevent the string from slipping off one end. The label should be tucked under the string to prevent undue flapping. The identity of the specimen (genus and species) should be written on the label. If the identity is uncertain, do not prepare as a skeleton, but make up as a skin.

A small bird sustaining undue shot damage should either be prepared as a skin or should be discarded. A bird which has two shattered wings or two shattered legs is useless either for dissection or as a skeleton.

My feelings on the need for numbers of *completely articulated skeletons* were expressed, in part, in an editorial several years ago (1951. Wilson Bull., **63**: 119–120). Anyone who has attempted to identify the phalanges of the foot and to reconstruct the several digits from a mass of separate bones is well aware of the problem implied here. Because small bones are easily lost, one can, for example, feel certain that counts of cervical and free caudal vertebrae are accurate only when it is possible to study articulated skeletons. Tabulation of the number of fused vertebrae in the synsacrum (a difficult and, perhaps, unreliable determination in the adult bone) may be meaningless unless one also presents the numbers of cervical, dorsal, and free caudal vertebrae; the total number of bones in the vertebral column may be the same in two specimens of a species even though there may be variation in the numbers of vertebrae in adjacent regions. Furthermore, I have now found variation, infrequent to be sure, in all regions of the vertebral column in several genera of the family Cuculidae.

Though perhaps not all ornithologists will agree with me, I prefer to work with "rough" rather than with shiny-white, bleached skeletons. I am not sure, when working with strongly bleached skeletons, how much of the bone has been eroded away; I prefer not to introduce this extra factor for error when taking measurements accurate to within 0.1 mm. I have examined strongly bleached skeletons of a particular species of cuckoo where the atlas appeared to be notched, rather than perforated, by the odontoid process of the axis, although in alcoholic material and in properly prepared skeletons of the same species, the atlas was invariably perforated. One rarely finds a patella, an os humeroscapulare, or an os opticus in a box of "thoroughly cleaned," disarticulated bones of a small bird. Furthermore, one can tell considerable about the myology of a species by inspecting the tendons still attached to the bones; sometimes relatively large aponeuroses leave no macroscopically visible impression on the bones.

It should not be necessary to say that the minimum data desired for study skins should also be recorded for spirit specimens and skeletons, yet I have received specimens with only the generic and specific names (sometimes not even the latter) recorded. An anatomist would like to have all of the data now considered minimal for the bird skin label: locality, date, name of collector, sex (for skeletons), and identification to species. In addition, the student of anatomy could often use to advantage ecological information, data on colors of soft parts, weight, wing area, and tail area. There is little published information on bird weights; there is even less on wing area (Poole, Auk, **55**, 1938: 511–517). Weight and wing area are indispensable factors when considering functional appendicular anatomy. Ecological and biological data are as important in determining degree of relationship as is the analysis of myology or osteology. On labels for skeletons, it is desirable to include data on plumage (whether it was of the male or female and of the immature or adult type). An even better procedure is to put on the label "like skin number —."

Fortunately, the day seems to have passed when long rows of bottled specimens were considered to have an intrinsic value. They do not have such value; unused specimens, whether they be "alcoholics" or skins, contribute nothing to our knowledge. In one instance, I was given permission to dissect but one side of a specimen because it was the only one in the collection. This policy was made even though the bird had been collected probably twenty-three (no date given) years earlier and it is unlikely that anyone else would be interested in dissecting this genus within the next twenty-five or fifty years.

That more care should be given to the preservation of spirit specimens is evident

from the fact that I have received several birds, preserved for twenty or more years, which had deteriorated so much that it was possible to determine accurately the extent and relationships of less than a dozen muscles. Other specimens of equal age, however, were in excellent condition.

One specimen is inadequate for the study of a subspecies. Why should we expect to obtain a satisfactory anatomical picture from a single specimen? Thorough dissection of one region frequently necessitates sacrificing some adjacent region or structure. Furthermore, it is difficult, if not impossible, to make an accurate dissection and description of each of the approximately 100 appendicular muscles in any given specimen. This would be true even were it not for the frequent shot damage which may make an entire appendage unusable. Nor can one adequately dissect the vascular, nervous, and muscular systems in the same specimen.

Though presenting more problems in the field than the preparation of a bird skin, "alcoholic" specimens and carefully prepared skeletons in numbers, with full data, are badly needed. A job worth doing at all is worth doing well. This aspect of ornithology deserves more emphasis than evidenced in recent years by the sponsoring institutions and by the leaders of field expeditions whose primary purpose is to collect study material.—ANDREW J. BERGER, *Department of Anatomy, East Medical Building, Ann Arbor, Michigan.*

Chipping Sparrow with song of Clay-colored Sparrow at Toronto.—The typical song of the Clay-colored Sparrow was heard on June 8, 1947, in the Don Valley at Toronto's northern limit. The singer, who had not been heard on numerous earlier visits to this residential area, was identified as a bird identical in appearance to a Chipping Sparrow. He was perched at the top of one or other of several small Lombardy poplars that dominated the surrounding gardens. He was again found on the next visit to this exact spot on June 17, 1947, unfortunately the last that could be made there that summer. He was heard to emit one song continually, *bzzz bzzz bzzz bzzz*, but no mate could be located. The following spring he, or an identical bird, was seen singing the same song in the same trees on May 3. Again no mate could be found; he was never heard again.

This observation is presented as another example of the ability of passerine birds to return on successive years to the same spot and suggests hybridization between the Chipping and Clay-colored sparrows although Clay-colored Sparrows are but transient irregular visitors in the Toronto area.—RONALD R. TASKER, M.D., *253 Old Orchard Grove, Toronto 12, Ontario, Canada.*

REVIEWS

Temperature Regulation and Water Requirements of the Brown and Abert Towhees, *Pipilo fuscus* and *Pipilo aberti*.—William R. Dawson. Univ. Calif. Publ. Zool., 59: 81–124, pl. 11, 26 figs. in text. 1954. Price, $0.75.—Dr. Dawson has compared the regulation of body temperature and the use of water by Brown and Abert towhees. The first lives in a district of California with hot days and the other lives nearby in an even warmer environment. At Los Angeles, *Pipilo fuscus senicula* encounters September days with weather reported as high as 35° C. but cooling to around 20° at night. In Imperial County where the Abert Towhees were obtained air temperatures approached 45° C. by day with low at night in July around 25° C. In both habitats the air was dry by day, but irrigation or cultivated vegetation made water available.

The towhees could stand about an hour of experimental exposure to temperature rising from 25° C. to about 45° C. At 40° C. their metabolic rates rose to nearly 3 times the basal level prevailing at thermoneutrality between 24° C. and 34° C. If they had been exposed to the diurnal temperatures indicated in weather reports their metabolic exertion would have been above the resting level during 7 or 8 hours daily.

My present outlook illustrates by contrast the wide temperature range successfully encountered in northern latitudes by physiological insulation. In recent mornings at Anchorage, dogs played as inconsequentially as usual in air which at −20° C. was about 60° colder than their bodies. In northern Alaska the larger wild mammals and even small birds like chickadees and redpolls proceed apparently undisturbed about their affairs in air which is 80° C. or more colder than their bodies. The large temperature range normally endurable below body temperature by arctic animals is in sharp contrast with the critical effects of the temperatures near those of their bodies which animals meet in the warm weather of many climates. For the physiologist it is easier to relate endurance of cold to temperatures which extend over 80° C. than the tolerance of heat in which, as Dawson shows, towhees pass from basal metabolic exertion at 34° C. to a rate of expenditure of energy and water at 40° C. which is not long tolerable.

At 5° C. and 23° C. both kinds of towhee kept body temperature near 42° by day but cooled about 3° immediately after the illumination was extinguished. Birds awakened at night promptly raised their temperature and the result was ascribed to activity induced by light. Reports of night declines in temperature of other species of birds indicate that the decline in body temperature at night occurs in many and is not related to cold. In winter nights at Anchorage around −20° C. we have found body temperatures sometimes 2° or 3° C. lower than by day, in 5 species of birds. Evidently our disturbance of the birds caused some of them to have normal daytime temperatures. The merit of Dawson's procedure is shown by the convincing regularity of his continuous records from thermocouples implanted in the birds' breast musculature.

In air at 39°, the towhees' body temperature was stable and only a little elevated provided that they had water to drink. At night the decline in body temperature was smaller than in cooler air. Without water, the body temperature was more elevated. The water evaporated by the birds increased with the temperature of the air.

Measurements of respiratory metabolism showed the minimum or basal rate to occur between about 24° and 34°. Above this thermoneutral range of temperature the towhees' metabolism increased rapidly. Of the total metabolic heat production,

evaporation dissipated an amount steadily increasing with heat production, but in air about 40° C all means for dissipation of heat could not keep up with the increased production of heat brought about by rising body temperature. Heat accumulated and the body temperatures rose.

It is interesting to see that the experimental analysis indicates the amount of heat which was accumulated in the birds and allows the inference that the storage permitted by the towhees' tolerance of hyperthermia is involved in their living through the hottest part of the day. They can thus accumulate a little metabolic heat by day, and presumably discharge the accumulation during the cool evening. On this regime, their precarious physiological state is apparent. Nevertheless these excesses over normal heat balance by day are naturally kept within physiological tolerance by behavior of the birds in seeking shade and especially by Abert Towhees through drinking and bathing. Abert Towhees were somewhat superior to Brown Towhees in the amount of drinking water which they could evaporate for cooling.

Abert Towhees showed some superiority over Brown Towhees in their combined physiological means for heat tolerance. These differences were numerically small but apparently significant. Figures quoted from Kendeigh's studies of heat tolerance by House Wrens (*Troglodytes aëdon*) and English Sparrows (*Passer domesticus*) could indicate equal or superior metabolic and evaporative ability and heat tolerance in these two birds naturally living in lower extremes of heat than the towhees. Dawson rightly avoids conjecture on the paradox between the physiological picture in these few species and their geographical distribution.

A reviewer can, however, venture that physiological descriptions of natural behavior are inadequate for description of life in hot climates. We can measure temperature upon an arithmetical scale to which the metabolism of arctic animals can be related in air until it is 70 or 80° colder than body temperature. Above the thermoneutral temperature however, Dawson's figures show impressively such a rapid increase in metabolism that it could only be plotted over a range of 8° C. I do not see how to analyze this short section of the complex reaction to heat, but the problem has been nicely prepared by Dawson in terms of physiology and behavior. At the rate of current progress, experimentation and natural history are about due to provide new descriptions which will clarify and which may explain the abundant and diverse distributions of animals in the hot climates where they are so near the limits of the tolerance which is imposed by the warm-blooded habit.—Laurence Irving, *Arctic Health Research Center, Public Health Service. Anchorage, Alaska.*

On the Biology of Some Javanese Loranthaceae and the Role Birds Play in Their Life-histories.—W. M. Docters van Leeuwen. Beaufortia, **4** (41): 103–207. 1954. It has long been known that birds are active in the dissemination of the seeds of the parasitic mistletoes (Loranthaceae). Both the common and specific names of the European Mistle Thrush (*Turdus viscivorus*) reflect its fondness for the fruit of this plant. In India, the East Indies, and Australia, the flowerpeckers or mistletoe birds of the family Dicaeidae have an even closer association with these plants. The alimentary tract in *Dicaeum* is especially adapted to facilitate the rapid passage of the seeds of the mistletoes, which are not digested; the pulp surrounding them is a source of food to the birds. When voiding the sticky seeds the bird expedites matters by rubbing its posterior against the twig on which it is perched. The mistletoe seeds stick to the twig, germinate, and grow there.

The blossoms of many tropical mistletoes are adapted for pollination by birds: brightly colored, odorless (Birds do not seek nectar by smelling it.), and with ample

supplies of honey within. The flowers often are so constructed that they remain sealed shut until forcibly opened by the bills of visiting birds, which become dusted with pollen as they probe for nectar. In regions where they occur, flowerpeckers seem to be the most active agents in the pollination of some genera of Loranthaceae, just as they are in the dispersal of the seeds. Mistletoes do occur, of course, in areas where the family Dicaeidae has no representatives, and conversely, the flowerpeckers themselves do not seem to be dependent upon these plants. Or at any rate a species of *Dicaeum* was found to have established itself on Krakatau following the volcanic cataclysm, before any mistletoes had reappeared.

The above are a few of the things discovered or confirmed by Docters van Leeuwen in his intensive studies in Java, which included experiments with captive, tamed mistletoe birds.—D. AMADON.

Birds of the Sudan.—Francis O. Cave and James D. Macdonald (Oliver and Boyd, Edinburgh) xxvii + 444 pp., 12 col. pls., 12 black and white pls., 2 maps, over 300 text figs. Price, 45 shillings.—The vast and highly diversified portion of Africa comprising the Anglo-Egyptian Sudan contains some of the best-known and some of the least-known parts of the continent as far as ornithological exploration is concerned. The great highway of the Nile Valley has been travelled by numberless individuals and parties, and its bird life has been the subject of a great many papers. On the other hand, the western half or so of the colony, from the arid wastes adjoining the southern borders of Egypt and Lybia, to the Darfur and Bahr El Ghazal Provinces, adjacent to French Equatorial Africa, the northeastern Belgian Congo, and Uganda, are much less known. Until the work of the late Admiral Lynes in Darfur some 30 years ago, that whole section was practically a blank on the ornithological map, and even today the data from there are quite spotty. In 1926 and 1931, W. W. Bowen issued a catalogue of Sudanese birds, and this list has remained the only comprehensive summation for the country until the appearance of the present book. Bowen listed 700 species of birds (not counting races), while Cave and Macdonald now record 871 species from the Sudan, an increase of nearly 25 per cent, a clear indication of the growth of our knowledge in the intervening quarter of a century. Including races, the Sudanese avifauna up to 1950 (closing date of this book) totals 1076 forms of birds.

Colonel Cave brings to his share of the compilation of this work an extended and extensive first hand knowledge of the country and its birds. Macdonald has supplied the "museum data," but has also profited by some personal observation of the land and its feathered inhabitants. The resulting volume is a condensed identification manual type of book; life history matters being either left out or only very briefly mentioned. In this the authors are probably justified as the first need for the man in the Sudan is a book that will enable him to name the birds he comes across in his studies. The condensed nature of the book may be sensed from the fact that this moderate sized volume describes the appearance and the occurrence of 871 species, and figures 106 of them in color and about 300 in black and white line drawings. It is as an identification manual that the book must be reviewed, and the lack of other types of information must be accepted as determined by the limitations of size. Within this category the book gives every indication of successfully serving the need for which it was written.

The twelve colored plates and the line drawings are all by D. M. Reid Henry, and are a notable addition to the iconography of African birds. If a criticism may be directed at the plates it is merely to point out that in a few cases scale is violated and the impression one gets of the size of a particular bird is a little inaccurate.

In their classification, the authors depart somewhat from other recent standard works on African birds, but not in ways that affect the usefulness of the book as a field manual. Thus the vultures are taken out of the *Accipitridae* and made a family *Aegypiidae*, while the *Accipitridae* are put into the *Falconidae;* the babblers are split into two families, the *Turdoididae* and the *Illadopsidae;* the oxpeckers are raised to family rank, *Buphagidae;* the weavers are split into *Bubalornithidae* and *Ploceidae;* and the finches into the *Fringillidae* and the *Emberizidae*.—HERBERT FRIEDMANN.

African Handbook of Birds, Series 1, Volume 1. Birds of Eastern and North Eastern Africa. C. W. Mackworth-Praed and Captain C. H. B. Grant. (Longmans, Green and Co., London) xxv + 836 pp., 53 col. pls., 6 photo pls., numerous text figs. and maps, 1952. 45 shillings.—This handsome, well illustrated and sturdily bound book, the first of two volumes, provides a handy compilation of the suboscine birds occurring in East Africa from the north Sudan border south to the Zambesi. The second volume will cover the oscines. The two volumes presumably comprise the first of a series of handbooks on African birds; we are not informed, however, concerning the proposed scope of the overall work.

The stated objective of the authors is to provide a concise reference book for use in the field, particularly for identification. They point out that the achievement of this objective necessitates sacrifices of introductory and descriptive material. The 25-page introduction is devoted largely to explanations of terms and procedures followed. Bibliographic references are omitted in the interests of space. Three pages, however, are given to the listing of over 600 authorities who contributed information, the names ranging from Linnaeus and Gmelin to the authors themselves.

Fifty-three color plates carry illustration of about 300 species, artistically and capably executed by Green, Grönvold, Reid-Henry, Kelly, and Lighton. We are told that 1027 species will be illustrated in color, the balance presumably to appear in the second volume. Most of the plates are subdivided into six 2″ × 2″ squares by heavy ruled lines, each square presenting a single species. Most of the artistic value of the paintings is lost by this severe reduction and much of their practical value as aids to field identification. The now familiar method of grouping many species on a single plate is more effective in a field guide and far more economical of space. Marginal maps showing range in solid black are presented for each species and subspecies. These were executed with considerable skill and care and are very useful despite their small size. Marginal sketches designed to illustrate characteristics of species not treated in the plates are generally well done. The uniform broad margins provided for these maps and sketches are very incompletely used however, and seem wasteful in view of the imposed space restrictions.

The nomenclature is essentially that of Sclater's Systema Aviμm Aethiopicarum incorporating revisions already published by the authors in *The Ibis* and the *Bulletin of the British Ornithologists Club* from 1933 to 1951. Species are treated under family or arbitrary family division headings. Artificial keys for identification are presented for each family. The account of each species contains brief descriptions of distinguishing characters, general distribution, range in Eastern Africa, habits, nest and eggs, recorded breeding, food, and calls, thus following essentially the outline used in the British Handbook of Witherby, *et al.* Much interesting material has been assembled for these accounts, but most impressive is the indicated paucity of information on habits, breeding, etc. With so little to present on many species it would seem that more effective condensing could have been accomplished in the

interests of producing a conveniently sized handbook. Considerable repetition occurs between headings, and some headings requiring a whole line of text contain no more information than "no information." Subspecies are given independent treatment, often with considerable repetition of material already given under the nominate race, or with a wordy comment referring back to the nominate race. The mapping of subspecies ranges might have been done more economically and effectively by combining them into species maps using appropriate shading and stippling for each race.

Despite these criticisms of organization, this handbook must be recognized as the first of its kind for East Africa. It should fulfill its stated objective of providing a well illustrated reference book of bird identification for the officials, settlers, and natives of East Africa. To this list might be added the temporary visitors and travelers, real or arm chair, interested in getting a general acquaintance with the fascinating bird life of this part of the world.—JOHN T. EMLEN, JR.

Land Birds of America.—Robert Cushman Murphy and Dean Amadon. New York, Toronto, London: McGraw-Hill. 4 preliminary leaves, pp. 11–240, 264 photographs (221 colored). 1953. Price $12.50.—Popular bird books have been issued in such numbers in the past few years that one is amazed at the continued demand. It is a pleasure to encounter one prepared by two professional ornithologists who are articulate, as well as technically competent.

The present work is primarily a pictorial effort, but it nevertheless contains a text touching lightly on many aspects of ornithology. The introduction deals with the history of ornithology and bird study, human awareness of birds, bird art, conservation, and other subjects. The rest of the text, designed as an accompaniment to the illustrations, is a running commentary covering the various groups of North American birds, arranged roughly in taxonomic sequence.

It is regrettable that, although generally informative and readable, the text shows evidence of hasty preparation. Otherwise we could pass on directly to the pictures, the book's principal *raison d'être* and the reason for its considerable initial cost. It is admittedly difficult, especially in popular writing, to qualify all statements in a manner satisfactory to specialists who are ever ready to quibble. In the present work this does not altogether excuse certain outright misstatements and half-statements which could easily have been avoided. The dodos (not dodo) were not restricted to a single island in the Indian Ocean; all Old World kites are not scavengers; the Marsh Hawk is not the only American hawk that nests regularly on the ground; the male Sparrow Hawk (*Falco sparverius*) does not have a slaty back; few mid-western ornithologists would agree that the Upland Plover is in danger of extinction; Kirtland's Warbler has been known to breed not in only three but in no less than fourteen Michigan counties; the Canada Warbler breeds from Georgia (not Connecticut) northward; Brewer's Blackbird nests on the ground or in low bushes as often as "in tall trees"; the Grasshopper and Savannah sparrows are not limited "to eastern hayfields"; and so on. The many lapses in the book do not do credit to the authors.

As mentioned, the main purpose of the book is found in its many illustrations, most of them colored. The work of a number of America's best bird photographers has been used to illustrate the various species, and some very fine pictures are included. Particularly excellent is a series of wood warblers at their nests by Eliot Porter (who has also supplied a short section on bird photography at the end of the book). Unfortunately, the average quality of reproduction is not good (see below). Also unfortunately, the authors have not been content to let the pictures speak for

themselves but have instead injected an argumentative comparison of the merits of bird photography and "bird art." The most concise expression of their views on this matter is found in sections entitled "Paintings of Birds" and "Birds in Color Photography" (pp. 11–14). The gist of their argument (which inferentially attacks almost the whole field of non-photographic ornithological illustration) seems to be that Audubon was, if not *the only*, then *almost the only* capable and worthy painter of birds ("Certain ornithologists may not agree with this estimate of Audubon's preeminence, but we have yet to find an artist who does not."). Without denying anything due Audubon, one cannot help supposing that the authors' acquaintance among artists, especially European, must be somewhat limited (What of Liljefors, Scott, Wolf, Millais, Thorburn, Lear, Kuhnert; and of Knight, Jaques, and Fuertes, among Americans?).

It is true that much so-called bird art has been bad art. There is need for fewer "bird artists" (in the restricted and all-too-frequent sense of the term) and for more artists who paint birds. But does this fact make it thoroughly safe to place undue reliance on the judgment of "artists" (unnamed) at large, or on "art critics" in particular? The authors naively state: "When we turn to such a published collection of great paintings as Thomas Craven's *Treasury of Art Masterpieces* [New York, Simon and Schuster, 1939], we find that Audubon is the only painter of birds to be included among the masters." They go on to quote Craven, never a man to mince words or qualify statements, in one of the most arbitrary opinions, even of Craven's, that this reviewer has read before or since the appearance of that volume: "As a painter of birds, he [Audubon] fixed a standard that has never been seriously contested, his most reverent emulators being no more than taxidermists. It is comforting to know that his pictures are ornithologically accurate . . ." In this remarkable mixture of purposes we find two ornithologists trying to be art critics quoting, in support of their opinions, an art critic trying to be an ornithologist!

The apparent reason for all this emerges with the statement: "This historical sketch indicates why we believe that color photography can now teach us much more about our birds than a further multiplication of painters' handiwork."

The whole argument is weakened by the authors' failure ever to distinguish clearly between the unattainable abstraction of perfectly accurate duplication of nature and the equally evasive quality of artistic worth. This confusion of values is evident in the statements: "[although subject to 'optical and chemical hazards'] the camera is free from personal bias. Illustrators and taxidermists prefer to draw or mount their birds in pretty poses . . ." and "[birds] fall into postures that appear unusual or even positively awkward, a fact which Audubon, almost alone among bird painters, had the forthrightness to express in his work."

This eulogy of photography proves most unfortunate in the present instance, though how much because of "chemical and optical hazards" and how much because of faulty color printing is hard to tell. In any event, it must have been embarrassing to have written: "For such truth a user of this book will find testimony in every color reproduction between its covers . . . camera likenesses more faithful than any artist's brush can paint or any taxidermist can reproduce, . . . through the unimpeachable records of color photographs . . .," and then to have found (to mention only the worst examples) the *green* chickadee (fig. 96), *cerulean blue* Water Ouzel (100), *blue* Western and *emerald green* Eastern Blue-gray gnatcatchers (103, 104), *blue* Solitary Vireo (136), brilliantly *blue-backed* Cape May Warbler (143), *lavender* Orange-crowned Warbler (155), *lead-gray* Oven-bird (165), *ultramarine* Slate-colored Junco (200), and the garishly *royal purple* Red-eyed Towhee (202).

Though the poor quality of many of these pictures is probably due to accidents of defective workmanship, the fact remains that *no graphic medium is perfect for all purposes*. Drawbacks pertain to color photography as a factual medium just as surely as they do to painting. Most of our fine bird photographers, who untiringly devote themselves to the improvement of their art, will probably agree to this readily. Color photographs seem harder to print accurately than paintings. Lenses and color films, though constantly being improved, are still far from perfect. Color values are difficult to photograph exactly, and the problem is further complicated because achievement of correct value in one part of the picture often throws off values in other parts differently lighted. This matter of contrast, as any photographer knows, is particularly troublesome in color work.

It is thus very difficult for the outdoor photographer to reproduce the flat local color often demanded in scientific illustrations, no matter how deplorable it may at times be artistically. To be sure, the camera lacks "personal bias" (except that supplied accidentally or intentionally by the operator), but this is merely another way of saying that the camera lacks intelligence, which, let us hope, is part of the equipment of at least some illustrators, whose chief advantage lies in their ability to circumvent or manipulate the physical laws which bind the photographer.

When speaking of drawing and painting versus photography as arts, comparisons are to be avoided. The subjects are no more comparable, so far as "worth" is concerned, than are painting and sculpture, water color and etching, ceramics and weaving. Let it suffice to say that works of art are difficult to produce in any medium and desirable in all. We owe much to those who create them, and should encourage "further multiplication" of "painters' handiwork" and photographers' efforts alike.—ROBERT M. MENGEL.

Birds of Southwestern Ohio.—Emerson Kemsies and Worth Randle. Cincinnati: privately published (lithoprinted). xii + 74 pp., 8 photos., 2 endpaper photos. 1953. Price $2.75.—This book actually amounts to a revised edition of the senior author's "Birds of Cincinnati and Southwestern Ohio," Ohio Audubon Society, Cincinnati, 1948 (reviewed by Maurice Brooks, *Wilson Bull.*, **61**: 119, 1949). The earier work, in turn, was little more than a revision of (and not in all ways an improvement on) Woodrow Goodpaster's "Birds of Southwestern Ohio" (*Jour. Cincinnati Soc. Nat. Hist.*, **22**: 6–40, 1941), although the fact is nowhere directly acknowledged. The work is considerably enlarged now, however, and available for the first time in durable and reasonably attractive format. It contains some material additional to that presented in its forerunners, many recent sight records and a few newly-taken specimens being mentioned.

Brief introductory material includes a general history of nature study in the area covered (Hamilton, Clermont, Butler, and Warren counties; parts of Clinton and Brown counties), definitions of terms, description of terrain, etc. The text proper is a briefly annotated list of birds considered to have been reliably recorded in the vicinity. One specimen or sight records by three experienced observers qualify a species for full standing in the list, less thoroughly documented forms being termed hypothetical. However, almost any vague record, no matter how ancient, of a bird killed seems to have been construed as an authentic specimen record. Listed are 300 species (including 12 hypothetical, and at least 3 unsuccessful introductions), 2 hybrids, and 12 additional subspecies. Some of the subspecies admitted are of very questionable validity and/or identification. For each form there is a brief definition of status, sometimes accompanied by miscellaneous remarks and particularly interesting records. Appended are a brief bibliography, sections on where to look for birds and on breeding bird and Christmas censuses, and indices.

The reader who is led by the title to expect a definitive or even fairly comprehensive treatment of the ornithology of the area will be disappointed. The authors mention but make small use of the work of Frank W. Langdon, Charles Dury, Ralph Kellogg, and others of the active group which in the period 1875–1900 made Cincinnati a lively ornithological center. Of the many titles on the birds of the area which appeared in that period, mainly in *The Journal of the Cincinnati Society of Natural History*, only one, Langdon's revised catalogue of 1879, is listed in the so-called bibliography. Some of the records of these early workers have as a matter of fact been included, but they are seldom specifically cited, and there is no convenient way for the reader to verify the records. To the important heritage of the work of that period, in the form of thousands of specimens in the Cincinnati Museum of Natural History, little attention (judging from the text) has been paid, and it is not apparent that the authors have personally checked a single one of the specimens. The carefully made recent records, frequently backed by specimens, of Maslowski, Goodpaster, Austing, and a few others reinforce an otherwise rather shaky structure.

One might also wish for more definite statement of the dates of occurrence, breeding status, and so on, of the different species than is given here in most cases. Some of the sight records are reported in a fairly convincing manner, but in many instances the authors have displayed what seems to me an excessive credulity, as in the account of the "Trumpeter Swan" recorded on November 8, 1951, and in the casual references to wintering Broad-winged Hawks. The following admonition (p. 31) will perhaps prove more revealing than the listing of further examples: "Identification of the four small *Empidonax* flycatchers is extremely difficult and should be made only after consulting one of the standard field guides." The writing is sometimes lacking in clarity.

Occasional remarks on subspecies are of negligible importance but betray some confusion as to just what a subspecies is. It is unfortunate that subspecific names were used at all in the present work.

Despite the shortcomings listed above, the work will prove helpful to ornithologists working in the area covered.—Robert M. Mengel.

Wildlife Abstracts, 1935–51. An Annotated Bibliography of the Publications Abstracted in the Wildlife Review, Nos. 1–66.—Compiled by Neil Hotchkiss, 435 pp. U. S. Dept. Interior, Fish and Wildlife Service. Price, $2.00, from the Superintendent of Documents, U. S. Gov't Printing Office, Washington 25, D. C.—The compiler, who has edited the Wildlife Review since 1948, has prepared a valuable work. The titles are briefly annotated, except in instances in which the title alone is sufficient to give the reader a good idea of the contents. The arrangement is by subject and in general follows that used in recent numbers of the Wildlife Review. A large index, in which the papers are listed both by subject and by author, adds greatly to the usefulness of the publication. The value of any bibliographic work ultimately depends on the completeness of the coverage; that of this work in turn depends on the coverage of the Wildlife Review, which in former years was not as extensive as it is now. Workers realizing this will find Wildlife Abstracts a valuable research tool, and those who do not have access to a complete file of the Wildlife Review will especially welcome this compilation. It is to be hoped that a similar volume will be compiled covering the next ten or fifteen years.—Robert W. Storer.

***Archaeopteryx lithographica*. A study based upon the British Museum specimen.**—Sir Gavin de Beer. London, British Museum (Natural History). xi + 68 pp., 15 pls., 9 figs. in text. 1954. Price, Two Pounds.—For some time

we have needed to reëxamine many of the avian fossils described during the nineteenth century in the light of our more advanced knowledge of the evolution and relationships of birds. The study here reviewed of the most important of all fossil birds by an eminent anatomist is therefore a particularly welcome addition to the literature of both ornithology and palaeontology.

Using X-ray photography and ultra-violet light, de Beer has been able to describe structures hitherto unknown. This new information has been added to what was previously described and the result is a thorough, monographic account. Aside from the descriptions of the various structures and comparisons with descriptions of the corresponding elements of the Berlin specimen, there are discussions of the history of the specimen and previous investigation carried out on it, the conditions of fossilization, the methods of study, the affinities with the Berlin specimen, the wider affinities of *Archaeopteryx*, and the origin of flight. An extensive bibliography, synonymy, and index are also included.

The author comes to the conclusion that the differences between the British Museum and Berlin specimens might be accounted for by differences in sex, age, and conditions of fossilization. Hence, he believes it is possible that both represent the same species. The lack of a keel on the breast bone and other characters associated with the pectoral girdle and wing, as well as the relatively small cerebellum, are used as convincing arguments in favor of the theory that *Archaeopteryx* was a glider and flapped its wings little if at all.

This monograph will undoubtedly prove to be one of great value for many years. It is to be hoped that its author will have the opportunity to apply his modern methods of study to the Berlin specimen, in this way will be able to solve more of the problems concerning the relationships of these birds.—Robert W. Storer.

An Introduction to Ornithology.—George J. Wallace. New York. The Macmillan Company. xii + 443 pp., 180 figs. 1955. $6.00—A long overdue addition to the literature of ornithology, this college text will prove popular in introductory courses and should also enjoy a wide reading among amateurs. The book is divided into two parts. The twelve chapters comprising the first part cover historical aspects of ornithology, a general summary of the bird in relation to other vertebrates, anatomy, behavior, events of the annual cycle (3 chapters), migration, distribution, food habits, economic relations, and conservation and management. The four chapters of part two are classification and nomenclature, the fossil record, ornithological methods, and ornithological organizations and their journals.

The list of 314 titles at the end of the book does not include any of those cited in connection with each chapter. Throughout the text the author shows an awareness of current ornithological research (192 of the 314 references bear dates of 1950 or later). He has been generally successful in including recent developments in a concise—perhaps sometimes too concise—manner calculated to convey a concept which beginning students can grasp and then apply in field or laboratory observation. As an example of an overly abbreviated-description, we read (p. 59), "The peculiar bill of the Black Skimmer (Fig. 33a) serves the unique skimming purpose implied in the name[273]." This is hardly an adequate description for one who does not already know the Skimmer or have access to Tompkins' description. Two or three additional sentences might be of help to a beginner.

The format of the book is pleasing: large well-spaced type with bold-face for emphasis makes for easy reading and the glossy paper provides an excellent surface for the reproduction of the photographs and line drawings. The line drawings are uniformly good, but three or four of the photographs are a bit fuzzy—probably

the fault of the original in most cases. It would seem that a sharper picture of a day-old Black Duck (fig. 98) might have been found.

The section on anatomy is adequate for beginning students and is presented in an interesting manner relating structures to their functions and adaptations. The anatomist may raise an eyebrow at such a statement as (p. 54–55), "The brain itself (fig. 54) can be summarily dismissed as being similar in structure and function to that of other vertebrates," or at the surely unintentional implication (p. 71) that a tendon is a flexor. The author may certainly be pardoned the commission of such anatomical sins in view of his inclusion of the true function (or lack of it) of the ambiens muscle; Beecher's work on the jaw muscles; and Miskimen's and Hazelhoff's works on the respiratory system.

Three chapters on "The Annual Cycle" are followed by one on "The Migration of Birds." This organization seems to set migration apart from the annual cycle. Perhaps a discussion of migration as the first of four chapters on "The Annual Cycle" might save a little repetition and tie it in with other activities of the bird. The 116 pages of these four chapters rightly form the core of the book, and Dr. Wallace has done an admirable job in presenting this phase of ornithology. Questions will be raised throughout the reading in the minds of every thinking student, and this section will prove to be the most stimulating for class discussions. From the vast literature of ornithology the selection of a few examples to illustrate his points must have posed quite a problem for the author. Anyone may argue that some particular example should have been included instead of one which was selected, but in general the author has chosen carefully and well, selecting familiar and widespread North American species wherever possible.

Dr. Wallace and the publishers are to be congratulated for bringing out a concise, up-to-date survey of the field of ornithology. Errors of commission and typography are surprisingly scarce for a book in its first edition.—L. M. Bartlett

Life Histories of Central American Birds: Families Fringillidae, Thraupidae, Icteridae, Parulidae, and Coerebidae.—Alexander F. Skutch. Pacific Coast Avifauna No. 31. Berkeley, California: Cooper Ornithological Society. 448 pp., frontispiece, 68 figs. in text. Price: $9.00 (paper covers), $10.00 (bound in buckram).—Skutch's earlier life history studies of Central American birds are familiar to most ornithologists, and several have been published in 'The Auk.' Hence, the organization, the wealth of detail, and the style of the accounts in this book require no special comment. The new work is a collection of life histories of nine finches (Variable Seedeater, *Sporophila aurita;* White-collared Seedeater, *S. torqueola;* Yellow-faced Grassquit, *Tiaris olivacea;* Blue-black Grosbeak, *Cyanocompsa cyanoides;* Buff-throated Saltator, *Saltator maximus;* Streaked Saltator, *S. albicollis;* Striped Brush-finch, *Atlapetes torquatus;* Orange-billed Sparrow, *Arremon aurantiirostris;* and Black-striped Sparrow, *Arremonops conirostris*); thirteen tanagers (Scarlet-rumped Tanager, *Ramphocelus passerinii;* Crimson-backed Tanager, *R. dimidiatus;* Red Ant Tanager, *Habia rubica;* Gray-headed Tanager, *Eucometis penicillata;* Blue Tanager, *Thraupis episcopis;* Golden-masked Tanager, *Tangara nigro-cincta;* Plain-colored Tanager, *T. inornata;* Yellow-browed Tanager, *T. chrysophrys;* Silver-throated Tanager, *T. icterocephala;* Blue-rumped Green Tanager, *T. gyrola;* Yellow-crowned Euphonia, *Tanagra luteicapilla;* Bonaparte Euphonia, *T. lauta;* Turquoise-naped Chlorophonia, *Chlorophonia occipitalis*); ten icterids (Yellow-tailed Oriole, *Icterus mesomelas;* Lesson Oriole, *I. prosthemelas;* Black-throated Oriole, *I. gularis;* Spotted-breasted Oriole, *I. pectoralis;* Melodious Blackbird, *Dives dives;* Chisel-billed Cacique, *Amblycercus holosericeus;* Montezuma

Oropendola, *Gymnostinops montezuma;* Yellow-rumped Cacique, *Cacicus cela;* Giant Cowbird, *Psomocolax oryzivorus;* and Boat-tailed Grackle, *Cassidix mexicanus*); five wood warblers (Pink-headed Warbler, *Ergaticus versicolor;* Buff-rumped Warbler, *Basileuterus fulvicauda;* Slate-throated Redstart, *Myioborus miniatus;* Collared Redstart, *M. torquatus;* and Hartlaub Warbler, *Vermivora superciliosa*); and three honeycreepers (Blue Honeycreeper, *Cyanerpes cyaneus;* Bananaquit, *Coereba flaveola;* and Slaty Flower-piercer, *Diglossa baritula*). The accounts of two of the warblers have been republished from 'The Wilson Bulletin'; the others are presented for the first time.

The choice of the groups included is a particularly fortunate one. All belong to the New World assemblage of nine-primaried song birds, a group about the interrelationships of which much has recently been written but much remains to be learned. While the icterids appear to be a fairly well circumscribed group, the other families discussed by Skutch here are not. Comparative life history studies like these are therefore of great value to systematists, first, in establishing a "norm" for the behavior of birds of a given family and, second, in placing the species of uncertain taxonomic position. It is particularly appropriate therefore, that Skutch has summarized his information on the birds of each family. The summary on the tanagers is especially valuable and constitutes the first good account of the habits of this family of birds.

All of the 40 species whose life histories are described in the text are illustrated by Don R. Eckelberry: a colored frontispiece shows four species of tanagers, and 36 particularly handsome black and white figures show the remaining species. Thirty-three photographs by the author illustrate the nests of eleven species, Central American habitats, etc.

This book is without doubt the most important so far published on the habits of tropical American birds, and it will be a valuable source of information for many years.—ROBERT W. STORER.

Records of Parrots Bred in Captivity (Additions).—Arthur A. Prestwich. (Privately printed, 61 Chase Road, Oakwood, London, N. 14. 80 pp. January, 1954. Price ten shillings.—Records of birds bred in captivity are important not only to amateurs but also to students of avian biology, as they often reveal peculiarities which have escaped the watchers of wild birds in nature. The Honorary Secretary of the Avicultural Society has spent a great deal of time and ingenuity gathering all available data on the numerous species of parrots which have nested in confinement. He has already published several volumes on the subject. A quantity of new information, however, has come to his knowledge since the appearance of his first reports, and the present volume is dedicated to it. His painstaking work is extremely useful not only to aviculturists, but also to all interested in the life habits of a peculiar and fascinating family.—J. DELACOUR.

Evolution of the Vertebrates: A History of the Backboned Animals through Time.—Edwin H. Colbert. xiii + 479 pp., 122 figs. in text. New York: John Wiley and Sons, Inc. Prince, $8.95.—In considering this book, comparison with Romer's established text, *Vertebrate Paleontology*, is inevitable. Generally speaking, Colbert's work is briefer and less detailed, and the bibliography is less extensive. Thus it may have more popular appeal, while at the same time it will be less useful to more serious students.

In this new work, birds share a short (13-page) chapter with the flying reptiles, and the three titles on birds listed in the bibliography do not include Lambrecht's

Handbuch der Palaeornithologie, probably the most important single source book on fossil birds, or Wetmore's classification of birds or his list of the fossil birds of North America. Those looking for information on fossil birds will find little of interest in Colbert's book; those looking for a general account of vertebrate evolution outside of this group will fare much better.—ROBERT W. STORER.

Finding Birds in Mexico.—Ernest Preston Edwards. E. P. Edwards and Co., Amherst, Va. xix + 101 pp., 7 pls. Price, $1.90.—This guide should prove very useful to anyone wanting to become acquainted with the common birds of Mexico. The introduction contains general information on the climate, vegetation, topography, and bird life. The first six chapters cover the major zoogeographic regions. The arrangement of these chapters is by towns, and for each town, there is information on the local birds, vegetation, and recommended hotels, auto courts, or camping places. The remaining parts of the book form a sort of appendix, containing sample bird-finding tours, a "habitat directory," a list of the birds of Mexico, a series of plates (in black and white) to assist the reader in identifying the common species, a directory of paved roads, a glossary of Mexican bird names, and an index of localities. The author has had much field experience in Mexico and knows the country well. The book as a whole reflects this, although there is some evidence of hasty preparation. This haste is particularly apparent in some of the illustrations. The head and neck of the Mexican Tiger Bittern (plate II, figure 21) were evidently copied from a painting by Sutton and a ridiculously small body and legs tacked on. The heads of the woodpeckers do not show the color patterns well; illustrators could use symbols or different kinds of shading to good advantage in plates such as this. Another possible criticism is that there is no information on where to find many of the less common species or those like the Tufted and White-throated jays and the Rose-bellied Bunting which have rather limited ranges. However, those wanting to find and identify the common birds seen along the highways of Mexico will find this book well worth its price.—ROBERT W. STORER.

Aves Venezolanas. Cien de la mas conocidas.—Kathleen Deery de Phelps. Creole Petroleum Corp., Caracas, Venezuela. 103 pp., 70 col. pls.—In this attractive publication are depicted one hundred of the best-known species of birds in Venezuela. Small-scale range maps are included, and brief captions (in Spanish) give information on the habits of the birds.—ROBERT W. STORER.

De Vogels van de Nederlandse Antillen.—K. H. Voous. Natuurwetenschappelijke Werkgroep Nederlandse Antillen, Curaçao. viii + 205 pp., 22 pls. (17 in color), 9 photos.—The six islands constituting the Netherlands Antilles, Aruba, Bonaire, Curaçao, Saba, St. Eustatius, and St. Maarten, do not form a natural geographic unit; the first three lie just north of western Venezuela, and the last three are at the northern end of the Lesser Antilles. And as might be expected, the avifaunas of these two groups of islands are quite different. Accordingly, in the annotated list of species, the distributions on the two island groups are handled separately. These species accounts also include sections on field marks, habits, distribution, and protection; a condensed summary in English concludes them. Although this book is primarily intended for visitors to the Netherlands Antilles, the accounts of the habits of the birds and H. J. Slijper's colored plates will prove helpful to ornithologists visiting other parts of the West Indies.—ROBERT W. STORER.

RECENT LITERATURE

EDITED BY FRANK McKINNEY

ALPERIN, I. M. 1954. A possible effect of sewage pollution on duck abundance. Proc. Linn. Soc. N. Y. nos. **63–65**, p. 74.—Concentrations of diving ducks near New York City may be brought about by the prohibition of clamming because of sewage pollution.

ANSLEY, H. 1954. Do birds hear their songs as we do? Proc. Linn. Soc. N. Y. nos. **63–65**, pp. 39–40.—No, their auditory perception is better.

ARNY, M. T. 1954. Observations on the Screech Owl (*Otus asio*). Proc. Linn. Soc. N. Y. nos. **63–65**, pp. 71–73.—On hatching, an owlet backed out of its egg shell. Eyes opened 6–9 days after hatching; they were blue at first and changed to amber 5–7 days after opening. Fledging period was 32 days for the oldest owlet. Young flew well at 5–6 weeks. Screech Owls can have over 400 Japanese beetle carapaces in one pellet; they will scratch for worms, bathe at twilight, and may bring food to the nest at intervals of only 3 minutes.

ATKESON, T. Z. and L. S. GIVENS. 1954. The use of livestock pastures in southeastern waterfowl management. Jour. Wildl. Mgt. **18**: 407–408.—Well-grazed pastures are attractive to geese.

BAGG, A. M. 1954. An Overlooked Turkey Vulture Record for Maine. Bull. Maine Aud. Soc., **10**: 63–64. Bird captured at Camden in 1910.

BAKER, E. J. 1954. Canada and Snow Geese at Merrymeeting Bay. Bull. Maine Aud. Soc., **10**: 40–43. Survey of the migration in the spring of 1954, and comparison of counts from 1944.

BARNES, I. R. 1954. A New Look at Bachman's Warbler. Atlantic Naturalist, **10** (1): 18–30. History and notes on behavior of *Vermivora bachmanii*.

BERGSTROM, E. A. 1953. Some Grand Manan Notes. Bull. Maine Aud. Soc., **9**: 82–83. Unusual records in August, 1953.

BOND, J. 1953. Additional Notes on Blackpoll Warblers. Bull. Maine Aud. Soc., **9**: 34–35. Supplements *ibid.* 1951; 7 (1) Notes from Prince Edward Island, Nova Scotia, New Brunswick, and the Gaspé Peninsula.

BOND, J. 1954. Notes from Mount Desert. Bull. Maine Aud. Soc., **10**: 56–58. Interesting observations in summer of 1954, particularly on southern forms, based on 25 years of study there.

BOND, J. 1955. Yellow-billed Cuckoos on Mount Desert. Bull. Maine Aud. Soc., **11**: 9. Numerous in October, 1954.

BOSSENMAIER, E. F., T. A. OLSON, M. E. RUEGER, and W. H. MARSHALL. 1954. Some field and laboratory aspects of duck sickness at Whitewater Lake, Manitoba. Trans. 19th N. A. Wildl. Conf. pp. 163–175.—Either botulism or blue-green algal poisoning.

BROOKS, M. 1954. Southern Appalachia As a Place for Bird Study. Raven, **25**: 144–151

BROWN, W. L., JR., and E. O. WILSON. 1954. The Case against the Trinomen. Systematic Zoology, **3** (4): 174–176.

CAMPBELL, H. 1954. Avian malaria in relation to survival and growth of a group of young Gambel's Quail in captivity. Jour. Wildl. Mgt. **18**: 416–418.—Infections caused by *Haemoproteus lophortyx* and *Plasmodium* appear to have had little consistently detrimental effect on young *Lophortyx gambeli*.

CAMPBELL, H. 1954. Use of oil dust baths by quail. Jour. Wildl. Mgt. **18**: 543.—In New Mexico, quail prefer to dust in places where a gallon or so of old motor oil has been dumped.

COULTER, C. W. 1954. Some observations of Mallards in Central Maine. **Bull. Maine Aud. Soc., 10:** 20–23. Remarks on nesting and banding recoveries.

CRUICKSHANK, A. D. 1954. Lincoln County Notes for 1954. **Bull. Maine Aud. Soc., 10:** 58–59.

CRUICKSHANK, A. D. 1954. Hurricane "Carol" in Lincoln County. **Bull. Maine Aud. Soc., 10:** 60–61. The Hurricane brought Sooty and Forster's terns and one Least Tern.

DAHLEN, J. H. and A. O. HAUGEN. 1954. Toxicity of insecticides to the Bob-white Quail and Mourning Dove. Jour. Wildl. Mgt. **18:** 477–481.—Order of decreasing toxicity: aldrin, dieldrin, toxaphene, and lindane. Doves about 3 times as resistant as quail. No substantial losses of birds in agricultural areas were noted.

DALE, F. H. 1954. Influence of calcium on the distribution of the pheasant in North America. Trans. 19th N. A. Wildl. Conf. pp. 316–323.—Because *Phasianus colchicus* feeds so extensively on cultivated grains, it may fail to meet its calcium requirements from nutrient sources. There is a correlation of pheasant numbers with availability of calcium over large areas in the eastern half of the United States.

DANE, N., II. 1954. Christmas Bird Count 1953. **Bull. Maine Aud. Soc., 10:** 2–7. Analysis of 31 censuses with total of 93 species listed.

DANE, N., II. 1955. Christmas Bird Count 1954. **Bull. Maine Aud. Soc., 11:** 4–8. 90 species listed.

DAY, R. L. 1953. The Geographic Distribution of Wildlife in Maine. **Bull. Maine Aud. Soc., 9:** 54–62. Covers mammals, birds, reptiles, amphibians and fresh water fish. 3 maps, 1 chart, 2 tables.

DREIS, R. E. 1954. A field observation method of aging broods of Wood Ducks. Jour. Wildl. Mgt. **18:** 280–281.—Tabulation of characteristics for five age classes.

EISENMANN, E. and J. L. BULL, JR. 1954. Peculiar behavior of Tree Swallows in relation to dead of their own species. Proc. Linn. Soc. N. Y. nos. **63–65,** pp. 73–74.—In October, an *Iridoprocne bicolor* apparently attempted copulation with a dead swallow crouched on a road surface; other swallows lit on dead birds of their own species and fed on insects or carrion.

ELDER, W. H. 1954. The effect of lead poisoning on the fertility and fecundity of domestic Mallard ducks. Jour. Wildl. Mgt. **18:** 315–323.—In the domestic Mallard, ingested lead pellets appear to depress fecundity but not fertility or hatchability.

ELDER, W. H. and M. W. WELLER. 1954. Duration of fertility in the domestic Mallard hen after isolation from the drake. Jour. Wildl. Mgt. **18:** 495–502.—Fertility and hatchability drop when hens are experimentally isolated from drakes. In the wild, renesting will apparently require remating; unbalanced sex ratios at the adult level appear to be essential to species survival.

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GOSLINE, W. A. 1954. Further Thoughts on Subspecies and Trinomials. Systematic Zoology, **3** (2): 92–94.

GRANT, R. H. 1954. Common Tern feeding from tin can. Proc. Linn. Soc. N. Y. nos. **63–65,** p. 74.—Several *Sterna hirundo* succeeded in taking half of the live fish from a fisherman's bait can on the beach.

GRIEB, J. R. and E. L. BOEKER. 1954. Waterfowl migration studies and their application to management in Colorado. Trans. 19th N. A. Wildl. Conf. pp. 195–210.—Fall migration occurs in a regular and definite pattern, by species, each year.

GRISCOM, L. 1954. Historical developments of sight recognition. Proc. Linn. Soc. N. Y. nos. **63–65**, pp. 16–20.—Dark forebodings on the decline of censorship and healthy skepticism in the avifaunal literature.

GRISCOM, L. 1954. Philosophy of waterfowl abundance. Trans. 19th N. A. Wildl. Conf. pp. 110–114.

HANSON, H. C. 1954. Apparatus for the study of incubated bird eggs. Jour. Wildl. Mgt. **18**: 191–198.—Egg volumeter, portable egg candler, and dark box for photographing eggs.

HEBARD, F. V. 1954. Mid-July 1953 on Lasell's Island, Knox County, Penobscot Bay, Maine. Bull. Maine Aud. Soc., **10**: 23–27. Description of the island and a bird list.

HERMAN, C. M. and E. E. WEHR. 1954. The occurrence of gizzard worms in Canada Geese. Jour. Wildl. Mgt. **18**: 509–513.—*Amidostomum anseris*, a roundworm, is widely distributed in *Branta canadensis* and contributes to low weights, poor condition and mortality.

HOCHBAUM, H. A., S. T. DILLON and J. L. HOWARD. 1954. An experiment in the control of waterfowl depredations. Trans. 19th N. A. Wildl. Conf. pp. 176–185.—Near Delta, Manitoba, patrol, gunfire and scaring devices were effective.

HUNTER, C. 1954. The value of bicolor and sericea field border plantings to quail in Arkansas. Jour. Wildl. Mgt. **18**: 343–347.—After a study of 1,336 miles of field borders, sericea with an annual lespedeza is recommended for *Colinus virginianus* in Arkansas.

JOHNSON, R. A. 1954. The behavior of birds attending army ant raids on Barro Colorado Island, Panama Canal Zone. Proc. Linn. Soc. N. Y. nos. **63–65**, pp. 41–70.—Birds attending the nomadic raids of *Eciton burchelli* feed on insects and other arthropods flushed out by the ants; they were not seen to eat army ants, show fear of them, or to "ant." Some follow the swarm throughout all or most of the day.

KOZICKY, E. L., T. A. BANCROFT, and P. G. HOMEYER. 1954. Analyses of Woodcock singing ground counts. Jour. Wildl. Mgt. **18**: 259–266.—An exploration of the use of present sampling theory in the study of populations of *Philohela minor* in northeastern United States and New Brunswick, Canada.

LEWIS, J. B. 1954. Further studies of Bob-white mobility in central Missouri. Jour. Wildl. Mgt. **18**: 414–416.—Movement in spring is somewhat greater than in late summer and fall.

LONG, R. H., JR. 1953. Status changes on Mount Desert Island. Bull. Maine Aud. Soc., **9**: 30–33. Changes in flora and bird life following fires in 1947.

LYON, L. J. 1954. Pheasant winter roosting cover preference in North-central Colorado. Jour. Wildl. Mgt. **18**: 179–184.—Heavy weeds and cattails highly preferred by *Phasianus colchicus* in northern Colorado.

MAYR, E. 1954. Notes on Nomenclature and Classification. Systematic Zoology, **3** (2): 86–89.—Three controversial subjects are discussed: (1) stability and the binomen, (2) subspecies, and (3) super- and sub-taxa on the family and ordinal level.

MCCALL, J. D. 1954. Portable live trap for ducks, with improved gathering box. Jour. Wildl. Mgt. **18**: 405–407.

MOORE, I. M. 1954. Nomenclatorial Treatment of Specific and Infraspecific Categories. Systematic Zoology, 3 (2): 90–91,

MURPHY, R. C. 1954. El Guano y la Pesca de Anchoveta (Guano and the Anchoveta Fishery). Lima, Peru: Compañia Administradora del Guano. 147 pp.—Thirty-two pages devoted to a well-documented plea for limiting the take of this fish and a discussion of the ecology of the anchoveta and its importance as the principal food of the guano fowl of the Humboldt Current. The remainder of the publication consists of official documents.

MURRAY, J. J. 1954. Biotic Zonation in the Southern Appalachians. Raven, **25**: 92–96. A review of the modified life-zone concept as applied to a mountain region.

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PACKARD, C. M. 1954. Cattle Egret collected in Maine. Bull. Maine Aud. Soc., **10**: 9.

PALMER, W. L. 1954. Unusual Ruffed Grouse density in Benzie County, Michigan. Jour. Wildl. Mgt. **18**: 542–543.—Fifteen nests of *Bonasa umbellus* on 105 acres.

PAYNE, W. D. 1954. Nest of the Arctic Three-toed Woodpecker. Bull. Maine Aud. Soc., **10**: 45–46. Description of adults and young. Nest, located in "burn," was five feet above ground. Diameter of nest hole was two inches.

PLUNKETT, A. 1954. Hummingbird Behavior and Metabolism. Redstart, **21**: 63.

PORTENKO, L. A. 1954. Synoptic tables, Fauna U. S. S. R., no. 54. Birds, **3**: 1–254, figs. 1–103. This book, published by the Academy of Sciences of the U. S. S. R. (which is not to be confused with the large handbook in six volumes entitled "Birds of the Soviet Union" by Dementiev, Gladkov, and other authors) deals with 15 families of Passeriformes. It is well illustrated by figures of diagnostic details and well printed on good quality paper. The text is in Russian but the new forms proposed, see below, are very briefly described in Latin in a series of footnotes: *Pyrrhocorax p. subdocilis, Aegithalos caudatus brachyurus, Cyanistes cyanus koktalensis, Parus major kapustini, Penthestes montanus shulpini, Sitta europaea partiaria, Tichodroma muraria ognewi, Troglodytes t. cineraceus, Oenanthe isabellina sibirica, Tarsiger cyanurus pacificus, Erithacus rubecula valens, Pseudaëdon sibilans swistun, Luscinia megarhyncha tauridae, Oreocincla dauma exorientis, Turdus viscivorus expetibilis, T. v. tauricus*, new subspecies.—Charles Vaurie

READ, B. W. 1954. Florida's Snailhawk. Atlantic Naturalist, **9** (5): 224–232. Ecological, life-history, and conservation notes on the Everglade Kite, *Rostrhamus sociabilis*.

REITZ, R. 1954. Birds meet with Disaster at the Brunswick Naval Air Station. Bull. Maine Aud. Soc., **10**: 61–62. Hundreds of warblers and thrushes flew against the doors of a hangar during the night of September 8–9.

SCOTT, F. R. 1954. Transient Warblers Attracted by Discarded Farm Produce. Raven, **25**: 133.

SIBLEY, C. G. 1954. The Contribution of Avian Taxonomy. *In* Symposium: Subspecies and Clines. Systematic Zoology, 3 (3): 97–126.—It is emphasized that subspecies and clines are not mutually exclusive concepts but rather different methods applicable to different situations. No completely satisfactory method of describing clinal variation has been developed as yet, but formal nomenclatural recognition is discouraged.

SKUTCH, A. F. 1954. Life history of the Tropical Kingbird. Proc. Linn. Soc. N. Y. nos. **63–65**, pp. 21–38.—*Tyrannus melancholicus* lays 2–3 eggs in Costa Rica, 4 in Guatemala, 3–5 in southern United States. Laying occurs late in the morning, on consecutive or alternate days. Only females incubate; eggs hatch in 15 or 16 days, young fledge in 18 or 19 days. Aggressiveness of adults toward harmless birds has been greatly exaggerated in the literature.

SOOTER, C. A. 1954. A technique for bleeding nestling birds by cardiac puncture for viral studies. Jour. Wildl. Mgt. **18**: 409–410.—Juveniles 4 to 30 days of age were bled as many as four times by a method described. Losses totalled about 2 per cent.

SPIEGEL, L. E. and R. E. REYNOLDS. 1954. Responses in weight and reproduction of Ring-necked Pheasants fed fruits of gray dogwood and multiflora rose. Trans. 19th N. A. Wildl. Conf. pp. 153–156.—*Cornus racemosa* and *Rosa multiflora thunbergiana* are shown to produce nutritious food for *Phasianus colchicus*.

SPRUNT, A., JR. 1953. Katahdin Glimpse. Bull. Maine Aud. Soc., **9**: 78–80.

SQUIRES, W. A. 1955. The Clapper Rail in New Brunswick and Maine. Bull. Maine Aud. Soc., **11**: 2–3. Summary of records; status, past and present.

STEWARD, R. E. 1955. Notes on Behavior of Ruffed Grouse Broods in Virginia. Atlantic Naturalist, **10**: 120–123.

STIRRETT, G. M. 1954. Field observations of geese in James Bay, with special reference to the Blue Goose. Trans. 19th N. A. Wildl. Conf. pp. 211–221.—The goose population in fall consists of 91–95 per cent *Chen caerulescens*, 1–6 per cent *Branta canadensis*, and 3–5 per cent *Chen h. hyperborea*. The percentage of juveniles each fall varied from 27 to 65 per cent. The hunting kill in the area runs about 78,000.

SWANK, W. G. and S. GALLIZIOLI. 1954. The influence of hunting and of rainfall upon Gambel's Quail populations. Trans. 19th N. A. Wildl. Conf. pp. 283–297.—Rainfall from December through April critically affects population levels.

TABER, W. 1952. Altitudinal Records. Bull. Maine Aud. Soc., **8**: 74–85. Altitudinal distribution of breeding birds and migrants on New England Mountains. Bicknell's Thrush occurs down to 2800 feet.

TABER, W. 1953. Winter Status of the Bonaparte's Gull in Maine. Bull. Maine Aud. Soc., **9**: 35–36. Probably a regular but local winter visitor in moderate numbers.

TABER, W. 1954. Forest Roads. Bull. Maine Aud. Soc., **10**: 28–30. The "forest" covers three times the area of Massachusetts. Analysis of regions and comments on those roads most desirable for observation of more northern forms of bird life.

TABER, W. 1954. Herring Gulls and the Hurricane. Bull. Maine Aud. Soc., **10**: 62–63. Gulls were at the mercy of the storm.

TORDOFF, H. B. 1954. An automatic live-trap for raptorial birds. Jour. Wildl. Mgt. **18**: 281–284.—Portable, automatic bow-net type.

WAGNER, F. H. 1954. Wild Turkeys in Wisconsin. Wisconsin Conserv. Bull. **19** (11): 11–14.—In 1954, 69 adult birds were stocked in the central part of the state.

WEHR, E. E. and C. M. HERMAN. 1954. Age as a factor in acquisition of parasites by Canada Geese. Jour. Wildl. Mgt. 18: 239–247.—Goslings acquired most of their infections during their first week of life.

OBITUARIES

ANASTASIO ALFARO (GONZÁLEZ), a Corresponding Fellow of the American Ornithologists' Union since 1888, was born February 16, 1865, in Alajuela, Costa Rica, and died on January 20, 1951. He attended the University of Santo Tomas and then located in the capital, San José. He devoted his long life to the study of natural history and taught several branches of this field in several institutions of higher education in his country. His studies embraced birds, reptiles, mammals, fish, insects, and plants. He collected in all these fields from boyhood, and many species, including a hummingbird and an ant tanager, were named after him.

In 1886, by special appointment of his government, he became a member of the Committee to Prepare a National Exposition. The Exposition was so successful, especially the ornithological exhibition, that he was sent to Washington to study administration in the Smithsonian Institution. The following year (1887) the National Museum of Costa Rica was founded and he became the Director, a post he held continuously until 1930 except for the years 1898–1903, when he was one of the administrators of the National Archives. He was delegate to the Exposition in Madrid in 1892, to the World's Fair in Chicago in 1893, and to the Central American Exposition in Guatemala in 1897. Among honors bestowed on him were the Royal Order of Isabel the Catholic in Spain, Knight of Sweden, and life membership in the Academy of Natural Sciences, Philadelphia. He began publishing in 1887 in Vol. I of the *Anales del Museo Nacional* and published many studies in this journal later. Among his major works are *Etnología centro-americana*, Madrid, 1893; *Antigüedades de Costa Rica*, San José, 1894; *Arqueología criminal americana*, San José, 1906; and *Mamíferos de Costa Rica*. In 1917 he published *Petaquilla*, a series of literary essays and poems based on observation of Nature. At the age of seventy-five he visited the countryside with the same enthusiasm for nature that he had shown in his youth and published an article on applied entomology each month in the *Revista del Café*.

I am indebted to Professors Juvenal Valerio R. and James Homer Herriott for assistance in the preparation of this notice.—A. W. SCHORGER.

HERBERT WILLIAM BRANDT, a Member of the American Ornithologists' Union since 1915, and a Life Elective Member since 1947, died at Homestead, Florida, March 8, 1955. He was born in Cleveland, Ohio, October 28, 1884. The degree of Mining Engineer was obtained from the Case Institute of Technology in 1907, followed by a Master's degree. While attending school, he was an outstanding athlete. His fondness for ornithology induced him to select mining engineering in order that he could be out of doors. After leaving Case, he followed his profession in Nevada and New Mexico for two years, then worked as a reporter for a time on the Goldfield Nugget.

He returned to Cleveland on the death of his father, to take over the family business of wholesale provision dealers, The Brandt Company, of which he soon became President. Possessed of ample means, he organized and led 42 field expeditions, four of which were in the Arctic. In 1954, with the aid of the Royal Canadian Air Force, he studied the Coral Harbor area on Southampton Island. Southward his activities carried him to Panama and Chile. These expeditions resulted in three notable ornithological contributions: Texas Bird Adventures (1940), Alaska Bird Trails (1943), and Arizona and Its Bird Life (1951). By the time of his death he had assembled a considerable amount of material for a fourth publication, Birding Down and Up America. This work was to cover his experiences with nesting birds

from the Florida Keys due north to the High Arctic. In all he studied the life histories of 710 forms of North American birds, of which 485 were full species. Few ornithologists approach these numbers even in a "life list."

His work in Alaska was rewarded in 1946, by an honorary doctorate from the University of Alaska, the first to be awarded to a nonresident of the Territory. In recognition of his interest in conservation, he received in 1953, the Nash Certificate of Merit.—A. W. SCHORGER.

JOHN MILTON EDSON, Honorary Life Associate of the American Ornithologists' Union, died in Seattle, Washington, June 13, 1954. He was born in Sinclairville, N. Y., September 29, 1861, and his formal education was obtained at Fredonia Institute and at Chamberlain Institute, Buffalo, N. Y. In 1885, he read a paper, 'Birds of Chautauqua County,' before the Chautauqua Society of History and Natural Science, that was published privately as a brochure of 14 pages the following year. George B. Sennett, likewise born in Sinclairville, was sufficiently impressed by the young man's ability that he nominated him for Associate Membership. On his election in 1886, Sennett wrote to him as though this was equivalent to a Christmas present, showing how much honor was attached to membership at that time.

He went to Seattle, Washington, in 1888, and shortly thereafter to Bellingham where he engaged in the newspaper and job printing business. In 1894, at the A.O.U. meeting in New York, he became acquainted with Elliott Coues. Immediately thereafter he supplied himself with sufficient books and equipment to permit serious work in ornithology through extensive collecting. Eventually, he was instrumental in founding the Bellingham Public Museum that was opened to the public in 1941. He served as director until 1945, when he retired and moved to Seattle. The thirteen cases in the Museum hold 317 birds and 21 mammals that he mounted, and in many instances he painted appropriate backgrounds. In addition, Western Washington College of Education is indebted to him for 54 specimens, and the Museum of the University of Washington for 700 skins of birds and 275 of mammals.

Several of his field trips are noteworthy. Leaving New Whatcom on July 20, 1892, with three companions, the top of Mount Baker was reached on July 31. Extensive notes were taken on birds and mammals. In 1905 he accompanied W. L. Dawson on an ornithological exploration of the San Juan Islands, when on occasion, gull eggs were used as a substitute for fresh water. His most memorable trip took place in 1920, when under the auspices of the Biological Survey, he accompanied Walter P. Taylor, George G. Cantwell, and William T. Shaw into the Cascade Mountains.

He was a member of the Cooper Ornithological Society and the Pacific Northwest Bird and Mammal Society. His ornithological papers comprise some 55 titles most of which appeared in 'The Murrelet,' and the remainder in 'The Condor,' and 'The Auk.' Aside from being a recognized authority on the birds of Whatcom County, he made exhaustive studies of the nesting of the Violet-green Swallow. One of them, 'Recession in weight of nesting birds' (Condor, 1930), received the Maillard prize of $100. He also furnished A. C. Bent some original observations on the White-winged Scoter.

In 1889, he married Alma B. Green who died in 1930. He is survived by a daughter Emily H. (Mrs. H. R. Mattox), and a son, Arthur A.—A. W. SCHORGER.

HARRY HARRIS, a Life Member of the American Ornithologists' Union, died at Eagle Rock, Los Angeles, California, June 11, 1954, at the age of 76. He was born in Moberly, Missouri, April 17, 1878, and was educated at the University of Michigan and Washington College, St. Louis, Mo. From 1897 to 1902, he was occupied with his work as a commercial artist, and from 1902 to 1921, he served as cashier in the Kansas City Post Office during which time his father was City Postmaster. Later he moved to California and was curator of the library of vertebrate zoology in the California Institute of Technology at Pasadena.

Harris was interested in birds from an early age. He was elected an Associate of the Union in 1911 and a full Member in 1919. He was also a member of the Wilson Ornithological Club and the St. Louis Academy of Science; and after he moved to California, he became active in the Cooper Ornithological Society, serving as President of the Southern Division and as Business Manager. He was energetic, blessed with unbounded enthusiasm, and never afraid of work. Having acquired a set of 'The Ibis,' he made a complete index of the biographical material in the various volumes, a careful but laborious work, which unfortunately is still only in manuscript. He was a careful, accurate, and interesting writer. His best-known publications are his 'Birds of the Kansas City Region,' 1919, his Memorial of Robert Ridgway, with a bibliography, published in 'The Condor' in 1928, and 'The Annals of *Gymnogyps* to 1900' published in 'The Condor' in 1941.—T. S. PALMER.

DR. LUDWIG SCHUSTER, vice president of the German Ornithologists' Union (Deutsche Ornith. Ges.), Corresponding Fellow of the A.O.U. elected in 1953, died on September 7, 1954. He was the founder and editor of the Beitr. Fortpflanzungsbiologie der Vögel (1925–1944) and, lately, editor of the "Vogelwelt." Throughout his life he devoted himself to the study of the breeding biology of birds, in Africa and Central Europe, and contributed much to the growing interest in this field. A special issue of the Journ. für Ornith. (vol. 94, no. 1/2) was dedicated to him on the occasion of his 70th birthday (January 30, 1953).—E. MAYR

ALICE HALL WALTER, an Associate of the American Ornithologists' Union since 1938, died at Providence, Rhode Island, December 1, 1953. Alice E. Hall was born at Lyndon, Vermont, on February 3, 1869. On August 25, 1896, she married Herbert E. Walter, then a high school teacher in Chicago. They had been high school sweethearts at Lyndon Institute. In 1906, after obtaining his higher degree at Harvard, Dr. Walter was appointed to the faculty of Brown University, and Providence became their home. He had been an Associate of the Union since 1901, and died in 1945. For some summers while he taught field zoology at the Long Island Biological Association Laboratory, Cold Spring Harbor, she taught small classes in bird-study there.

I first knew Mrs. Walter prior to 1920, when she was contributing articles of a more or less editorial nature to the Audubon Society department of Bird-Lore magazine. Popularizing bird-study may be considered to have been her life work. To her bird-study was a part of Science, and in Science, the steady progress of which one may trace through centuries of peace and of war to the present, she had faith. In the September–October, 1916, issue of Bird-Lore, she makes the point that bird-study should conform to scientific standards and not be allowed to become just a plaything of persons superficially interested. Both this editorial, and Witmer Stone's Comment on it in the following January Auk (p. 117), as well worth rereading today.

I knew her best around 1928, when she was compiling data from years of intimate study of the bird life at Cold Spring Harbor, Long Island. There is an old letter from her dated August 5 of that year regarding my impending visit to the laboratory, which would give us opportunity of going over together plans for its publication. It was probably on that visit that I was presented with a copy of the Twelfth (1926) edition of her and her husband's "Wild Birds in City Parks," first published in 1901, for its fly-leaf is inscribed with both their names, and dated August 7, 1928. Though he always retained an interest in ornithology, hers was latterly the more active. One usually thinks of them together. They observed an Arkansas Kingbird together on Nantucket Island, September 13, 1933, which she mentions in a letter that lies before me, and she also recorded it in the Auk.

Both Dr. and Mrs. Walter had a long and active service in the Audubon Society of Rhode Island. Both were officers, he a president and later vice-president; she chairman of the education committee for years and years, during which she engineered, with her co-workers, a useful and most varied program for adults and for schools.—JOHN T. NICHOLS.

THE SOUTHWESTERN RESEARCH STATION OF THE AMERICAN MUSEUM OF NATURAL HISTORY

The American Museum of Natural History has announced the establishment of The Southwestern Research Station. It is located on the eastern slope of the Chiricahua Mountains, near Portal, Cochise County, in southeastern Arizona. The property is within the limits of the Coronado National Forest at an elevation of 5400 feet.

The station was established for the purpose of making available research facilities for scientists and students in all branches of science, who have problems that can be investigated through the utilization of the faunal, floral, and geological features of the area. It will be open during the entire year.

It is operated by the American Museum of Natural History, Central Park West at 79th Street, New York 24, New York and under the direction of Dr. Mont A. Cazier, Chairman and Curator of the Department of Insects and Spiders, to whom all inquiries should be addressed. Anyone interested in the station should write to the above named individual for the booklet which gives the details of the operation and a general description of the area.

THE AUK

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ORGAN OF THE AMERICAN ORNITHOLOGISTS' UNION

For publication in 'The Auk,' articles or notes must present material that is of significance to ornithologists and that has not been published elsewhere. All manuscripts should be typewritten, double spaced, with wide margins. Titles should be brief. Terminal bibliographies are used as a rule for long articles. Only works actually cited in the text are to be included in these bibliographies; works not so cited will be deleted by the editors. Where fewer than five references to literature are made, they may be inserted in parentheses in the text. References in manuscript for 'General Notes' should be in the text. Consult issues of 'The Auk' since January, 1949, for style of citation. Long articles should be summarized briefly. Footnotes, Roman numerals, and ruled tables are to be avoided. Acknowledgments belong in the text. Line drawings must be in India ink on white paper or drawing board; usually these should be planned for at least one-half reduction when printed. Thus, details and lettering must be correspondingly large. Legends must be brief. Photographs must be hard, glossy prints of good contrast. Common and scientific names of North American birds should follow the A.O.U. Check-List and supplements except in taxonomic papers giving critical discussions.

Proofs of all articles and notes will be sent to authors. Reprints from articles, 'General Notes,' and 'Correspondence' are to be paid for by the author. These must be ordered from the Editor on the blanks sent with the proof and must be returned with the proof. Printed covers can be furnished at additional cost.

All articles and notes submitted for publication and all books and publications intended for review should be sent to the Editor.

ROBERT W. STORER, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

All persons interested in ornithology are invited to join the American Ornithologists' Union. Application may be made to the Treasurer; dues for Members are $4.00 per year. 'The Auk' is sent without charge to all classes of members not in arrears for dues.

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CHARLES G. SIBLEY, *Fernow Hall, Cornell University, Ithaca, New York.*
